FEB 7 1923
CHEM. LIBRARY
Chemical Library
FEB 7 1923

GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. CLXI. No. 3115.] LONDON, JANUARY 24, 1923. [75th Year. Price 1s.

OXIDE OF IRON
SPENT OXIDE

GAS PURIFICATION AND CHEMICAL CO., Ltd.
PALMERSTON HOUSE, LONDON, E.C.2.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 London Wall.

PUMPING ENGINES
All Types for ACID, &c.
CAST-IRON OR STEEL TANKS
Any Capacity.
CHEMICAL PLANT.
Roofs and Girders. Structural Work.
Air and Gas Compressors.
MIXERS.
TAR STILLS AND CONDENSERS.
SULPHATE OF AMMONIA PLANT
W. NEILL & SON, Ld.
Engineers, Iron & Brass Founders,
ST. HELENS JUNCTION.
Telegrams: 'Neill, St. Helens.' Telephone No. 34

ASK BERK.
SULPHURIC ACID
(made from Spent Oxide)
FOR
SULPHATE MAKING
F. W. BERK & CO., LTD.,
1, Fenchurch Avenue, E.C.
Abbey Mills Chemical Works, Stratford.
Pentrepoth Chemical Works, Morriston.

"TORBAY PAINT"
FOR ALL PURPOSES.
The TORBAY PAINT CO.,
26/28, Billiter St., LONDON, E.C.
51, Old Hall St., LIVERPOOL.

"BLUEBELL"
SILICA RETORTS
(95% SILICA)
John G. Stein & Co., Ltd.,
Castlecary, SCOTLAND.

Telephones: 3966 VICTORIA. 3967 Do.
Telegrams: "GASIFICATION, Sowest, LONDON."
WALTER MOORE & SONS,
GAS COAL & COKE CONTRACTORS,
72, VICTORIA STREET,
LONDON, S.W. 1.

W. & B. COWAN
(Incorporated in Parkinson and W. & B. Cowan, Ltd.),
LONDON. MANCHESTER. EDINBURGH. GLASGOW.
SYDNEY. MELBOURNE. BRISBANE. WELLINGTON, N.Z.
(See Advertisement on p. III. of Wrapper.)

JAMES McKELVIE & CO.
Coal Owners,
Gas and Steam Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
GUILDHALL CHAMBERS, SANDHILL,
NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
ESTABLISHED 1845.

STEWARTS AND LLOYDS, LIMITED, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.

Meter Dependability →

55 years of constant and satisfactory use is evidence of the unique reliability which has characterised George Glover's Gas Meters since 1861. These features of endurance are enhanced in the

"Ranelagh"
Price-changer, Pre-payment Gas Meter

A well-known Gas Undertaking writes:
Nov., 1922.
"....we have this week taken out a dry tin cased gas meter, made by George Glover, dated 1867—that is 55 years ago. This meter has been in use and working until now."

GEORGE GLOVER & CO., LTD.,
RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W. 3.
Branches: 74, Diamond Street, Cardiff.
Ranelagh Meter Works, East Park View, Leeds.
City Meter Works, Port Street, Manchester.

Costs by using FERNDOWN ELASTIC PAINT twice as long as other Paints. FERNDOWN, LONDON, S.E. 16.

HORSELEY

OUR experience in constructing Gas Holders dates back to the beginning of the gas industry. In those days—as now—we were looked upon as one of the leading constructional engineers. Those responsible for producing equipment for the new gas industry naturally turned to us for assistance, just as previously we had the honour of building the first iron steamboat and earlier locomotives.

Ask us to quote you for Gas Holders, Tanks, Lamp Columns, and Constructional Work of every description.

THE HORSELEY BRIDGE AND ENGINEERING Co. LTD.
CONSTRUCTIONAL ENGINEERS AND GAS PLANT MANUFACTURERS
HEAD OFFICE AND WORKS: TIPTON, STAFFORDSHIRE

B DONKIN D

DONKIN

for

DISTRICT SERVICE GOVERNORS

HIGH AND LOW PRESSURE SERVICE REGULATORS, METER REGULATORS,
STOVE AND LAMP REGULATORS, SERVICE CLAMPS AND FITTINGS.

THE BRYAN DONKIN COMPANY, LTD.,

Head Offices & Works, CHESTERFIELD.

LONDON OFFICE: 3, VICTORIA STREET, WESTMINSTER, S.W. 1.

Chesterfield Telephone No. 84.
London Telephone No. 3358 Victoria.

Chesterfield Telegrams, "Donkin, Chesterfield."
London Telegrams, "Donkin, Vic. London."

B CHESTERFIELD D

GAS JOURNAL

LIGHT ⁘ HEAT ⁘ POWER ⁘ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

PROPRIETORS: WALTER KING, LIMITED. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

Telephone: Holborn 6857. —— Telegrams: "GASKING, FLEET, LONDON."

VOL. CLXI., No. 3115.] WEDNESDAY, JANUARY 24, 1923. [75TH YEAR.

EDITORIAL NOTES.

Therm Consumers and Local Authorities.

THERE is every reason to be gratified over the course the therm inquiry is taking. The "therm," we have full confidence, is coming out of the analytical investigation as a soundly proper basis of charging for gas. From the proceedings at the fourth day's sitting, certain features emerge that are worth emphasizing. They relate to the questions of (1) educating the consumers; (2) the information given on gas accounts; (3) the attitude of some authorities in regard to the testing of gas, and therefore the protection of the consumers; (4) the values of high and low calorific grades of gas; and (5) the therm standard price. These are only side issues from the main question. And on the main question—high gas accounts, and the influence of the therm upon them—the inquiry is depriving the complaint of all the substance with which certain newspapers contrived to clothe it; and the shadow left is hardly discernible. In his evidence at a previous sitting, Mr. D. Milne Watson showed what a small proportion of the consumers out of the enormous total supplied by the Gas Light and Coke Company had made complaint during the period of the campaign; and now we have Mr. William Cash, F.C.A., the Chairman of the Bournemouth Gas and Water Company, stating that, though they have 15,000 ordinary consumers and 17,000 prepayment, they have received only twenty letters of complaint referring to the therm system since its introduction. It is abundantly clear, too, that local authorities realize the slender character of the evidence over which there has been all the newspaper hubbub. The Chairman of the Committee (Sir Clarendon Hyde) announced at the sitting last week that the Committee had sent invitations to over 100 authorities in Greater London. These authorities represent the public. But the result of the invitation was that only four desired to give evidence; thirty-one did not wish to do so; thirty-three acknowledged the communication, but gave no definite answer; four protested against the therm method of charging; and thirty had not troubled to reply at all. There is only one deduction to be made from this attitude—that no substantial grievance exists; otherwise local authorities in force would be before the Committee.

Taking the first two points to which we have directed special attention. At various times during the inquiry, the opinion has been expressed by members of the Committee that the blame for much of the outcry (such as it was) was due to there having been insufficient explanation given to the consumers at the advent of the therm system. The extremely valuable evidence of Mr. William Cash relating to the different Companies with which he is associated—all operating in distinct circumstances—is a complete refutation of this assumption. The companies did all that could be reasonably expected of them in disseminating information. In this matter, the companies cited are only representative of most others; and we submit for the consideration of the Committee that it is the lethargy or heedlessness of the consumers themselves, rather than any laches on the part of gas suppliers, that is really responsible for any public ignorance on this matter. This applies, too, to the form of accounts sent to the consumers. From many places in the country evidence has been coming that, from the start of the system, accounts have been rendered showing both the cubic feet consumed and their equivalent in therms based on the declared calorific value. The more the matter is probed, the greater the disclosure of the hollowness of the newspaper agitation and of the charge of indifference on the part of the gas suppliers. And not only from that point of view but from others is this so.

Regarding the protection of the consumers, every gas-supplying undertaking that applies for an Order under section 1 of the Gas Regulation Act voluntarily places itself under all the obligations directed to the protection of the consumers that are imposed by the Act. This is a point that should be particularly noted. But those obligations are, in the main, a matter for the local authorities, as representatives of the public. The duty of the gas suppliers is to deliver the therms; the duty of the local authorities is to see that they are delivered. Therefore any grievance or doubt as to whether the calorific quality is there which constitutes the therm is a matter not between the gas consumers and the suppliers, but between the consumers and the local authorities upon whom falls the duty of making the necessary tests, and appointing competent examiners for the purpose. But in the evidence which he gave, Mr. W. J. Atkinson Butterfield, one of the Gas Referees, rather pointed to certain local authorities being desirous of economizing as much as possible in this respect, by utilizing the services of a gas examiner to the minimum allowable extent. Where such an attitude is taken, it may be regarded as something in the nature of a compliment to the gas suppliers, and as implying a full confidence in their honesty in respect of thermal value. Though, however, the local authorities are the acting agents in this matter for the consumers, their views may not be those of the consumers as a whole; and therefore the administrators of gas undertakings would much rather the tests be sufficiently full and satisfactory, in order that there should be no room for complaint as to the inadequacy of the assurance given to the consumers. The Gas Referees have the power of prescription; they have no power outside that conferred by the Act. But they are doing their utmost to persuade those authorities who are disinclined to do more than their minimum duty in this regard to extend their ideas and performances; and they are hopeful of success.

On this point as to the testing of gas, a matter was raised which appears to us to have very little to do with the reference to the Committee. It alludes to the qualifications of examiners; and it was introduced by Mr. Marlow on behalf of the Institute of Chemistry and the Institute of Physics. It was urged that the attainments and qualifications of the gas examiners should be of a high order—that they should be fellows or associates of one of the two Institutes, or graduates of a recognized University who have taken chemistry and physics in the final examination for their degree, or associates of technical colleges, provided that their diplomas include chemistry and physics, or qualified engineers with adequate training in these subjects, certified by a recognized University or College. A candidate for a gas examinership should produce evidence of having had actual experience of the work under qualified supervision, and must be fully cognizant of the laws and regulations relating thereto; and, further, it is desirable that he should be a member of a reputable professional body of chemists, engineers, or physicists. This is placing attainment and qualification far too high. Local authorities who are economically inclined in this matter would look somewhat askance at the remuneration that such qualification—eminently desirable no doubt—would seek and command. There might not, with such minimum qualification limits imposed, be suffi-

cient willing candidates to go round. We are not surprised to find that Mr. Butterfield, when questioned on the matter, was not prepared to go so far as the Institutes concerned. So little complaint is heard of the present gas examiners that one cannot say they are unsatisfactory; and Mr. Butterfield deliberately declared that he should be sorry to say the experienced man is not as competent as the highly trained man. We entirely agree, too, with his belief that there would have been considerable resentment by local authorities had it been suggested that they should be dictated to as to whom they should appoint. However, we do not think this matter need trouble the Committee. The two Institutes have made their point, so that it is there for further consideration, should the authorities think it desirable. If there is any question as to the competency of an examiner, it is distinctly a matter for settlement between the gas consumers and the local authority.

Part of the agitation in the Press referred to the fact that some companies after experience had raised the declared calorific value of their gas by 2 to 5 p.ct.! The grotesque views which exist on this subject are well represented by the statement, at this sitting, of Mr. A. Ball, a member of the Sunbury District Council, that "the gas, being of greater heat, was perhaps affecting the meters!" We need not criticize such a critic, or rather inventor of a new reason for high gas accounts. We merely quote the statement for illustration purposes. One of the virtues of the Gas Regulation Act is that it permits the declaration of any calorific value of gas within reasonable limits that can be most economically produced; and those who initiated the basis for the Act knew that, within those reasonable limits, any gas will, by the necessary adjustment of the burner, give the consumer approximately equal efficiency. The reasons for this will be found in the valuable evidence of Sir Dugald Clerk reported this week, as well as in that of Mr. George Helps, though, by the way, the latter gentleman would gain more interest for his theories and proposals if he adopted a less assertive attitude, and modified his sweeping charges in respect of the practices of the major part of his professional colleagues. There will be interest in reading our report of what transpired in this connection at the sitting of the Committee last week. Of course, one cannot determine on any general principles the calorific quality that it is best to supply in any area. Decision must be on the economic facts applying to individual cases. Mr. Cash made this point well in his evidence, when he showed that, while in Croydon or Tottenham 500 B.Th.U. gas is the best to supply, in Bournemouth 450 B.Th.U. gas gives every satisfaction, and is, with the manufacturing plant employed, the most economic quality. It was also shown how, with an increase at Tottenham in the declared value from 450 to 500 B.Th.U., comparing the Michaelmas quarter of 1921 (when the former was supplied) with the corresponding quarter of 1922 under the higher declaration, there had been an actual decrease of 12·62 p.ct. in the cubic feet sold, and 2·91 p.ct. in the therms sold. Yet the atmospheric conditions last year were more favourable to domestic consumption, though probably industrial use was not in its best form owing to the prevailing depression.

Finally as to the standard prices per therm, it is interesting to learn that the Croydon Corporation regard the therm basis as theoretically sound; and Mr. W. R. Herring stated that the Ilford District Council also approve of it, but consider that the standard price is too high. Mr. Councillor Brown, of Southall, also thinks the therm basis is scientifically correct; but he asserted that the Brentford Gas Company's charges were too high. Before the war the price was 2s. 4d. per 1000 c.ft., and now it is equivalent to 4s. 2½d. There was no difficulty on the part of Mr. A A. Johnston to counter Mr. Brown's complaint with the costs of manufacturing materials and labour; and it was rather a humorous situation when it was pointed out by him to Mr. Brown that the district rate had increased from 3s. 6d. to about 7s. 6d. or 8s.—anyway the Gas Company are now paying the District Council in rates practically double what they were paying pre-war. It is no use local authorities jumping to conclusions as to whether or not standard prices are correct in current circumstances, nor is there any value in comparing the standard price in one area with that in another—even though the areas are adjoining. This was well illustrated in Mr. Cash's evidence.

The confidence we formerly expressed as to the final result of this inquiry is being strengthened the larger the volume of evidence becomes.

The "B.C.G.A." and the Public Health Idea.

THE public do not fully appreciate the part that gas plays in the promotion of more hygienic home and atmospheric conditions, and the influence that this has upon health, upon the amenities of life generally, and upon the efficiency of all workers. The public look upon gas as a convenience and a labour saver. Their appreciation of this cannot receive better testimony than the business which is being done, and which is constantly extending. But the important service that is being rendered from the health point of view, and the scope that remains for more and more being accomplished in this direction, require promulgation from all available platforms. The time is opportune for taking this work in hand. The injury to public health through smoke-polluted air is a topic which is receiving more prominence than ever. We are therefore glad to find that the British Commercial Gas Association are cultivating the public health idea. Public health cannot be assessed in pounds, shillings, and pence; but every intelligent man or woman knows that the higher the standard of health, the better in all respects for the nation and every individual. Get that idea, or rather truth, well into mind, and a way is paved that will be found easy going for instilling into the public mind the contributory part of gas in the elevating of conditions that are of both individual and national advantage. And in this work the aid of many public, professional, and independent men in other walks of life will be quickly enlisted, which aid would in all probability be frequently denied if approached from any other standpoint.

The "B.C.G.A." are organizing a series of District Conferences in which the question of public health will be the predominant feature; and to it the promoting service of gas will be linked. The combination is a natural one, when one regards the debilitating conditions which a smoke-polluted atmosphere imposes, and which deprives humanity from much health-giving sunshine. For this in the home there is no compensation, inasmuch as the fuel that produces the smoke is there an effective agent of uncleanliness and labour. About these matters the public heard at the first of the conferences, held at Cardiff, and from men whose names are household words in that city. At the conference, the Chairman of the Cardiff Gas Company (Mr. C. E. Dovey, J.P., F.C.A,) presided; and the Lord Mayor of Cardiff (Dr. J. J. E. Biggs) was there, and evidenced a keen interest in the advances of science, which have added so much to the efficient utilization of gas. The authors of the papers read on this occasion were both local men. There was Dr. Ralph M. Picken, the Medical Officer of Health, who made a contribution to the question of atmospheric pollution and disease; and he departed from the beaten track in treating of his subject by its examination in the light of local conditions. No gas man could have dealt with the subject in precisely the same way. This may also be said of the paper by Mr. E. C. Morgan Willmott, A.R.I.B.A., who dilated upon "Public Health from the Architect's Point of View." Both medical officers and architects are influential men; but the gas industry does not want the members of either profession to treat of the assistance that the gas industry can render the cause of public health unless they are fully convinced that it can do so. Both authors have faith in that direction. Gas used as it is intended to be, and not misused, is a proved and valuable agent in contributing to more healthful conditions for the mass of the people.

Dr. Picken, looking at the fairly clear air of commercial and residential Cardiff, and as far as Swansea, is convinced that, in that particular area at all events, domestic smoke is not the terrible criminal that it is charged with being in other areas; and he rather inclines to the view that industrial smoke is the greater sinner in the large industrial centres. If Dr. Picken had experience of the densely populated residential suburbs of London, he would have good cause to know that circumstances—particularly atmospheric—alter effects, and that the domestic chimney is the only thing that can be arraigned for the change for the worse in atmospheric conditions that comes about after 6 a.m. on the mornings between late autumn and early spring. Even so, we quite agree with him that areas like Cardiff, which are not suffering to any great extent at present from smoke, but do not know to what extent they may be eventually exposed to it by altered local circumstances, should receive protection. He instances one way in which this might be afforded. It would be, he submits, no hardship on a new factory to ask

that it should submit to a local authority a description of its furnaces, boilers, &c., so that the authority might be assured that the best practicable means were being adopted for preventing a nuisance. There is no need to-day, with the experience of coke and coke breeze for steam-raising, as well as gas with the surface-combustion system, and the high efficiencies realized, for smoke-producing boiler-houses. Therefore the suggestion of Dr. Picken would inflict no hardship on industry, but would tend to the adoption of those non-smoke-yielding methods which fortunately, properly applied and operated, are the most economical for industry itself. Later on in the paper, the author outlined a scheme for domestic heating, which can claim, and would obtain, the endorsement of the most ardent gas advocate.

The paper by Mr. Morgan Willmott proves him to be an architect who has advanced with the times. In the architectural profession, one often sees the abiding influence upon work of the inculcated fundamental principles and the contemporary practices of the days when the aspirant for professional position was serving his articles. Current designs for new houses all too frequently prove that the responsible architects know comparatively little of the scientific progress in those things that should assist them to create changes in both the fabric and the equipment of dwelling-houses. But here we have an architect who asks for help to destroy the old-fashioned fetish of the coal fire, and to show his client that he may have a clean, bright, warm, dust-free house without it, and at a less material cost to himself. The contribution of Mr. Morgan Willmott assures us that he does not require much (if any) help in these particular matters; for had he been a gas engineer he could not have given better reasons than he has done for the adoption of gas, nor could he have shown greater advantages in applying gas to all heating purposes (with the exception of one coal fire) in the house that he is building for himself. He shows how gas gives to the architect greater scope in planning a house. He is of opinion, too, that there has been an under-estimate in placing the economy of house construction, through the employment of gas heating, at approximately 5 p.ct. In the building of his house, he finds that the saving is 7 p.ct., or £185. The paper was full of point—not omitting congratulation to the makers upon the improvement they have effected in the appearance of gas-fires, and a criticism of the old type of gas-oven with its base almost touching the ground.

If the other district health conferences under the auspices of the "B.C.G.A." have as interesting material for discussion as this particular one, there will be general and considerable satisfaction in the gas industry with the work afoot for implanting in the mind of the community the public health idea in relation to the use of gas.

Coal Output and Exports Last Year.

CONTRASTED with the returns of recent years, the coal output of this country was very satisfactory in 1922; and yet a still better condition of things in respect of production is necessary if the cost of coal at the pithead is to be reduced. An increased output is the only means by which overhead charges can be lowered; and, in the current circumstances of the coal industry, this appears to be the sole source (apart from transport and distribution) of further economies. Preliminary to this is a revival of industry, and the creation of a greater demand, so that there may be full employment at the collieries, perhaps supplemented by a reversion to an eight-hour day. The output last year totalled 251,849,600 tons; and promoting this improved state of affairs were the American and Canadian demands, owing to the protracted strike of miners in the States, together with the considerable recapture of the markets abroad. During the year, there were marked fluctuations in output. In the second quarter, the production was down to 57,551,800 tons, which was approximately 5 millions below the first quarter, more than 6 millions under the third quarter, and nearly 11 millions below the fourth quarter. Excluding Christmas holiday week, since August, with the exception of once, the weekly output has been above 5 million tons, which figure previously during the year was only reached in four weeks. The highest production was in the week ending Dec. 16—viz., 5,741,600 tons; the lowest output was during the week ending June 10—2,681,800 tons. The production for the year (251,849,600 tons) compares with 229,424,120 tons in 1920 and 163,162,644 tons in 1921—the year of the three months' stoppage.

The full returns as to exports are now available; and they show that this country has been very successful in recapturing the markets abroad. A few figures will illustrate this. In 1913, the exports made the record figure of 73,400,118 tons; last year the shipments totalled 64,198,384 tons—this comparing with only 24,931,853 tons in 1920, and 24,660,552 tons in 1921. This shows the remarkable success of the year in the work of recovery. The gas coal export business made an extraordinary flight during the year—the Continent being largely responsible for this. The quantity shipped coming within this category was no less than 9,197,544 tons, as against only 3,740,744 tons in 1921, and 2,204,571 tons in 1920. The value of the 9,197,544 tons was £10,123,199, which averages a trifle over £1 2s. per ton. Taking all classes of coal included in the total exports of 64,198,384 tons, the average value was a fraction of a penny over £1 2s. 7d. per ton.

The December returns show that 759,486 tons of gas coal were exported during the month, with a value attached of £849,195. In December, 1921, 675,953 tons were exported, of a value of £862,403. In December, 1920, 292,991 tons were shipped, of a value of £1,101,479. These figures compared show some extraordinary changes—particularly the quantity and the value for 1920, contrasted with the figures for December of last year.

CO Redivivus.

ACCIDENTS of various sorts have an unkind way of coming in the form of epidemics. Sometimes there is a crop of railway accidents, at other times fires, and fires and fatalities due to electricity. There has been scattered trouble lately through gas accidents, which the newspapers have managed, by big type and sensational writing, to dress up as an epidemic. Two or three of the worst of these accidents have arisen from causes for which the gas-supply undertakings concerned are in no wise responsible. For the rest, they are not attributable to accident, but to sheer carelessness and to suicide; and for these the gas industry can be in no way responsible. One cannot deny that there has been an increase, since Prof. Bone began writing to "The Times" on the subject of carbon monoxide, in the number of people who, instead of jumping before railway trains or into rivers, drinking a poisonous solution, or putting revolvers to their heads, have placed gas-conveying tubes in their mouths, their heads in gas-ovens, or have opened gas-taps in bedrooms, and left them on. The Bethnal Green gas-main accident gave Prof. Bone another opportunity of which he could not refrain from taking advantage, and so he indited a further letter to "The Times." In this he himself describes the death-roll from gas poisoning during 1922 as "high." "W. A. B.'s" article in "Nature," "The Times" reference to it, and Prof. Bone's letter in the same paper in January last year appear to have inaugurated the period of the "high" death roll. In the letter suggested by the Bethnal Green accident, Prof. Bone says this is a sufficient comment upon the folly of the decision of the Departmental Committee who inquired into the question of carbon monoxide in town gas. We see nothing in their decision that can justify this expression of opinion. In our view, the "high" death-roll, having regard to previous experience, shows, with the strongest emphasis, the folly of the newspapers in trying to work-up something sensational from a risk no greater than other risks in everyday life. With such a voluminous escape of gas as that which was caused through the breaking of a gas-main at Bethnal Green, whatever the percentage of carbon monoxide in the gas, there was bound to be serious trouble without due precautions were taken by the people in the neighbourhood. Everybody knew there was gas about in considerable quantity. There were only three deaths out of the large number of residents in the street; and, in view of the exceptionally bad circumstances, this shows that precautions must have been taken by others that were not taken by the people who unfortunately met their deaths. It was the same gas, with the same percentage of carbon monoxide in it, that entered all the houses.

We must protest against the manner in which Prof. Bone in his letter speaks of the percentages of carbon monoxide. He ought to remember that he is writing for laymen, and not addressing men who have knowledge of these matters, or students in his lecture-room. He writes: "A straight "coal gas contains no more than 7 or 8 p.ct. of it, which, "in all ordinary circumstances, may be considered as a not

" very dangerous proportion; but blue water gas, which is " nowadays so frequently mixed therewith at the gas-works, " contains between 42 and 45 p.ct. of it—a highly dangerous " proportion." This was fuel for the ill-informed newspapers. Promptly they, not knowing better, commenced to make comparisons of the old gas containing 7 or 8 p.ct. of carbon monoxide, with the new gas containing the " dangerous proportion of 42 to 45 p.ct. They know nothing, or profess to know nothing, of the mixture of the two gases which brings down the percentage to 15 or 16—at any rate, well under Dr. Haldane's 20 p.ct.

Prof. Bone again appeals for a public inquiry *de novo* by a Special Committee. Thereupon the "Pall Mall Gazette" protests against the apparent indifference of the authorities —notwithstanding the very full and complete inquiry that was held in 1921 by a Committee appointed by the Board of Trade. Our evening contemporary describes the gas supply of to-day as a " new peril," and says the underlying cause is unquestionably carbon monoxide. The " Daily Mail " comes out with an article, headed " Dangerous Gas," and states that a gas far more dangerous than formerly is being supplied for domestic use. Their teachers are sadly deficient in their methods of imparting instruction. Even if they do not divulge the fact, they know as well as we do that the proportions of coal gas and water gas are in these days approximately those that obtained for years before the war, and that, during the war and the coal strike, the percentages of water gas, and therefore of carbon monoxide, were substantially enlarged; and there was no abnormal trouble. The increase in the number of deaths—especially from suicide—that have occurred during the past twelve months coincides with the period that the newspaper columns have been used to attempt to stir-up agitation. We saw that " The Times " recently, with its pretence of knowledge of gas manufacture and carbon monoxide, spoke of the raising of the percentage of carbon monoxide to 6 when " iron " retorts were introduced. The " Pall Mall Gazette " caps this with: " When " coal gas was distilled [*sic*] in the old-fashioned fireclay " retorts, there was scarcely any carbon monoxide, or at " the worst a mere trace of it. When fireclay retorts were " superseded by iron retorts, the carbon monoxide found in " coal gas was not more than 6 p.ct. Water gas, on the " other hand, contains approximately 42 p.ct. of carbon " monoxide." There again, apart from the stupid blunders as to fireclay and iron retorts, the public will believe that there has been a chemical change in the gas supplied to them, representing a flight from 6 to 42 p.ct. of carbon monoxide. This is a case of ignorance trying, by sensational means, to fan-up an agitation, and on information obviously insufficiently explicit and complete. We cannot compliment the protagonist in this matter on the intelligence or the methods of these papers in their endeavours to assist him. One of the best evidences of the safety of gas is the fact that there are so few accidents in the houses of the working-classes where the prepayment system is employed.

There was further attempted sensation promotion by the papers over the temporary illness of some children who were at a dance at Crawley, Sussex, the other evening. The dance was in a hall heated by two gas radiators, which were installed three years ago; and the proprietor states that they have been working satisfactorily the whole time, have given no trouble, and are in good working order now. Examination of them has disclosed no defect. Why, therefore (after three years' use, and dancing classes held in the hall every week), it should be assumed that, on this particular evening, the radiators should make a departure from their usual good behaviour, is not at all clear. But the London evening papers raved again, and once more dragged in carbon monoxide!

Certain of the electrical papers have also been making much out of the gas accidents, and the use of gas for suicidal purposes; and, unintelligently informing themselves from the daily papers, they too believe (quoting the words of one of them) that the later developments of gas manufacture have unquestionably increased the danger of gas poisoning. Is Prof. Bone enamoured of his supporters and their misrepresentations?

Is Gas No Longer Necessary?

There are humorists on the London County Council. The *agenda* for yesterday's meeting showed that one of the members is anxious that inquiry should be made as to whether recent enterprise on the part of the electricity undertakings of the Metropolitan Borough Councils of Hackney, Poplar, Marylebone, Stepney, and Woolwich tends to show that gas is no longer necessary for the running of houses, in respect of lighting, heating, and cooking. Going to Press while the Council are sitting, we do not know what (if anything) transpired regarding this matter. Anyway, if inquiry is to be made, we hope it will be extended to an investigation of how the heating requirements of the whole community are to be met by the conversion of coal to electricity, and at what cost; also how the industrial needs of the country—chemical and otherwise—are to be satisfied if coal carbonization, and therefore gas production, is to be discontinued. The author of this idea has not a shadow of notion as to its consequences. The same notice of motion intends to direct the Public Control and General Purposes Committee to consider and report as to whether or not legislative or other steps should be taken to secure that gas companies should not spread illness and death by poisonous fumes, whether as a consequence of imperfect gas or faulty gas mains or pipes inside and outside buildings. The author of this motion, had he possessed better knowledge of the facts, would, we hope, have allowed justice to guide his pen, and have framed it in another way.

CO and Counter Action.

The question has been put to us as to whether anything is going to be done, by one of the central organizations, regarding the carbon monoxide newspaper campaign. We cannot say. Accidents, suicides, and gross carelessness in which gas is concerned are all having carbon monoxide associated with them; and big type is being used, and much space is being expended, in the work of making something sensational out of it. Statements are being made that are positively ludicrous; " scientists," real and unreal, are writing for the papers anonymous articles on carbon monoxide. Much harm is no doubt being done. When, asks our inquirer, is some counter movement going to be made by a representative body of the gas industry? We will not publish all he had to say regarding a slow-to-move policy when publicity is urgently desirable. This hint, however, will indicate the views he expressed.

Identified.

At the sitting of the Departmental Therm Committee last week, a statement was made by Mr. E. J. Fottrell, Joint Manager of the National Gas Council, that it was Mr. John Reid, the London Manager of Pleno, Ltd., who, during the " high gas " accounts agitation, wrote letters to the Press, under the pseudonym of " Gas Engineer " and " Gas Consumer," suggesting that the apparatus supplied by gas companies was wasteful. This disclosure by Mr. Fottrell will not be pleasant reading in the gas industry—particularly in view of the attempted prejudicing of gas undertakings having been made anonymously. Mr. George Helps protested against personal matters being introduced; but he does not appear to have denied the assertion.

Gas Mains and Highway Diversions.

There is great activity at the present time—partly due to the anxiety to reduce unemployment—in making highway improvements. The work is being carried out by the Roads Board, in conjunction with county councils and local authorties. In some cases, portions of highways are being diverted, and the old parts will cease to exist. This will be a serious matter for gas undertakings with trunk mains under the closed parts of old highways; and one can imagine all sorts of inconveniences and difficulties arising from this, if the matter is not dealt with promptly. Any gas undertaking that finds itself in this position should communicate the facts immediately to the National Gas Council, so that their position may be safeguarded. Certain notices have to be given; hence the necessity for no delay in taking action.

Gas Coke Exports in 1922.

With a shipment of 94,985 tons in December, the quantity of gas coke exported last year was 911,307 tons, the total value of which was £1,287,079, or an average of £1 8s. 2·9d. per ton. This average value per ton is a big drop from 1921, when only 443,565 tons were exported; but the value was £918,081. The figures

for 1920 assert themselves even stronger—the shipments then being 770,265 tons, and the value as much as £4,751,605, or an average per ton of £6 3s. 4·5d.

Imports of Gas Oil, &c., in 1922.

There was a decline in the imports of gas oil last year in comparison with 1921—the figures being respectively 70,153,258 gallons and 76,826,082 gallons. There was a substantial increase in the imports of motor spirit, but a reduction in fuel oil. Motor spirit was received to the amount of 311,190,222 gallons, as against 251,098,155 gallons in 1921. The quantity of fuel oil imported was 392,618,470 gallons; the figure in 1921 being 531,282,436 gallons. The total imports of petroleum products in the twelve months amounted to 1,213,108,362 gallons, as compared with 1,161,042,403 gallons. The general decline in prices is shown by the respective values of these quantities—viz., £39,135,412 and £54,500,464.

Sulphate of Ammonia Shipments.

The quantity of sulphate of ammonia exported last month was 17,954 tons, which brought up the total in the twelve months to 145,292 tons. In 1921, the amount exported was 128,493 tons; so that last year there was an increase of 16,799 tons.

The Miners and a Six-Hour Day.

The coalowners are again suggesting that the miners should revert to an eight-hour day, which it is submitted would give an effective working time of about six-and-a-half hours. The miners and their leaders, however, appear to have no idea of making the change; on the contrary, they are looking forward to a descent in working time rather than an increase. The Sankey Commission recommended a six-hour day to come into operation on July 13, 1921, subject to the economic position of the industry at the end of 1920 permitting. Mr. Frank Hodges, the Secretary of the Miners' Federation, points out that the Commissioners in their report stated that the six-hour day would be justified as soon as the annual output of coal was raised to 287,000,000 tons. "When the unemployed are absorbed, when the workmen can work a full week, 287,000,000 tons will be secured; then the miners will ask that the recommendation of His Majesty's Commissioners shall be translated into law and a six-hour day established." Then, if this came about, down would come the output, and up would go the costs of production.

Railway Coal Rates.

The Mining Association have made another appeal to the railway companies for a reduction of the rates for the conveyance of coal; but though a promise has been made to consider the figures submitted as soon as circumstances permit, the reply did not sound very hopeful. The case put forward for a reduction of the mileage charge on coal to 50 p.ct. above the pre-war rate, and the abolition of the 2d. per ton flat rate, was that the reduction to the present figure of 60 p.ct. had stimulated the flow of traffic without loss to the railway companies. In October, 1921, the mileage rate on coal was 100 p.ct. above the pre-war charge, with a flat rate of 6d. per ton. In October, 1922, with the increase above the pre-war rate at 60 p.ct., and the flat rate at 2d., the railway companies' revenue from coal, coke, and patent fuel traffic was £300,281 more than that of the corresponding month in the previous year. This rate of increased receipts, which had been maintained, it is calculated, amounted to £3,600,000 a year. Operative costs of the railways had, it was further pointed out, decreased by about £10,000,000 per annum. The railways, it was urged, had received in October, 1922, an average payment per ton of coal carried of 3s. 11d., as compared with 2s. per ton in 1913, or an increase of 96 p.ct. As to the average pithead price of coal, it was 67 p.ct above the average price of 1913, and although the output had been increased to 23,619,400 tons in November, 1922, as compared with 19,524,400 tons in November, 1921, the revenue of the coal industry, when these months were compared, had decreased by £360,000. This, it was contended, was a contribution by the coal industry to the revival of trade generally. The Advisory Committee, in its recent report to the Secretary of Mines, had emphasized that the railways must make further reductions in freights as early as possible, and so contribute their share.

PERSONAL.

Congratulations to Mr. R. M. CHART, J.P., and his wife on the celebration of their golden wedding. Mr. Chart, who is 72 years of age, is a well-known public man in Mitcham; and his numerous offices include that of Director of the Wandsworth, Wimbledon, and Epsom District Gas Company.

Dr. CHARLES CARPENTER, the first Chairman of the Council of the Association of British Chemical Manufacturers, has resigned his seat on that body, owing to pressure of other duties; and Dr. CLAYTON, M.P., has been elected to fill the vacancy thus created.

We learn that Mr. C. FOSTER VEEVERS, who has been for twenty-four years Engineer and Manager, and for nineteen years Secretary, of the Northfleet and Greenhithe Gas Company, is relinquishing the latter position, to enable him to devote more time to the engineering duties.

The Wolstanton Urban District Council have decided to increase the salary of the Gas Manager, Mr. CHARLES LOVERIDGE, to £500 per annum. It was pointed out by the Chairman (Mr. W. J. Hassam) that the present salary was a long way behind those paid at other works of the same size, and that in Mr. Loveridge they had one of the best servants it was possible to secure. Mr. Hardwicke said Mr. Loveridge was the lowest-paid gas manager in the district.

FUNERAL OF JAMES W. HELPS.

Many friends gathered at Shirley Church, near Addiscombe Park, Croydon, last Thursday afternoon, to offer their last tribute of respect to the memory of an old and valued past worker in the cause of the gas industry—James William Helps. As on the stroke of three the cortège entered the sacred fane, among the family mourners following were recognized Mr. and Mrs. Douglas Helps, of Reading, Dr. G. C. Helps, Mr. and Mrs. Vivian Ryan, Mr. and Mrs. Vincent Bird, and Mr. F. E. Shum. The solemn ordinance was most impressively conducted, and several favourite hymns were included in the service. Music rendered by the organist at the opening and close enhanced its beauty. Then came the retiring processional preceded by the clergy, the graveside, the poignant but exultant committal sentences, and the final reverent salutations.

On every hand were heard expressions of affection and esteem for the friend who had passed to the great beyond. From the Croydon Gas Company were present a number of workmen by whom Mr. Helps had been so beloved during his association with them when Engineer, and since. The Chairman of the Company (Mr. Charles Hussey, J.P.) and Deputy-Chairman (Mr. Thomas Rigby) attended, with the Engineer and Works Manager (Mr. A. Caddick), the Distributing Engineer (Mr. W. J. Sandeman), and the Secretary (Mr. W. W. Topley). There were also present Dr. Charles Carpenter, President of the South Metropolitan Gas Company; Dr. Newnham, Town Clerk of Croydon; Mr. Thomas Hardie and Mr. A. E. Broadberry, Past Presidents, and Mr. W. T. Dunn, Secretary, of the Institution of Gas Engineers; Mr. James C. Walker, Secretary of the British Commercial Gas Association; Mr. D. T. Livesey, of East Grinstead; Mr. E. Scears, of Redhill, and other members of the Southern Association of Gas Engineers and Managers.

Slowly we left God's acre as the sun was setting. The stillness of the air and quietness pervading all around seemed to suggest the happiness of rest for our brother, the sense of consolation for those from whom he was parted.

Manchester District Institution of Gas Engineers.—The next meeting will be held on Saturday, Feb. 24.

Irish Gas Referees.—The Irish Free State Ministry of Industry and Commerce have appointed as a Board of Gas Referees Messrs. F. J. Allen (Chairman), M. Ryan, B.E., and P. O'Callaghan, Associate of the College of Science, Dublin, and A.I.C.

Yorkshire Junior Gas Association.—The Chairman and Directors of the Wakefield Gas Company have invited the members of the Association to visit their Vicarage Street Gas-Works next Saturday afternoon; and after the inspection Mr. H. L. Bateman will deliver his Presidential Address.

Institution of Engineering Inspection.—We have received a copy of the objects and aims of the Institution of Engineering Inspection, which was founded in 1919 as the Technical Inspection Association by the members of the Inspection Department of the Ministry of Munitions. The underlying idea is "the elimination by skilled inspection of all defective material and workmanship, so that the world's buyers may with certainty rely upon the uniformity and excellence of all British productions." The Institution has been formed to meet the increasing demand for highly-skilled inspection, both by the manufacturer during production and by the purchaser before delivery. There is to be a meeting at the Society of Arts on Friday, Feb. 16, at 7.30, when Mr. H. T. F. Rhodes will read a paper on "Chemical Inspection as it Is and as it Should Be." The offices of the Institution are in Palace Chambers, Westminster.

ELECTRICITY SUPPLY MEMORANDA.

There has been much talk in the electrical journals regarding the success of the Glasgow Corporation Electricity Department in letting-out on hire electric cookers. Glasgow has not an insignificant population; but so far only 397 cookers of the electrical brand have been fixed. In view of this, it is suggested that 200 more cookers should be purchased. But it seems that not all householders who have electric cookers are, after experience, disposed to keep them. There are some who prefer to revert to gas-cookers. This means for the Gas and Electricity Departments a waste of time and money. The matter has become sufficiently serious for the Housing and Improvements Committee to take note of it; and they have reported on the subject. It appears that canvassers from the Electricity Department have succeeded in persuading several tenants of Corporation houses to have their gas-cookers displaced and electric cookers installed. With the results of the latter, some tenants are dissatisfied; and so they have asked for the restoration of their well-tried and trusty gas-cookers. Through this, considerable inconvenience has been caused to both departments. In an attempt to prevent a recurrence of this, the Housing and Improvements Committee have resolved not to allow any further changes until the consent of the Manager of the City Improvements Department has been obtained.

Returning to Gas-Cookers.

Salesmen and Lighting.

The electrical salesmen at their seventh conference in London had before them a long paper, by Mr. J. W. Beauchamp, the Director of the British Electrical Development Association, on "Selling the Electric Idea." This seems rather an abstract sort of thing to sell; but, of course, the salesmen present knew that Mr. Beauchamp's "idea" is electricity for everything to which it is economically or uneconomically applicable. He reminded his hearers that a feature of missionary work is to train the disciple not only in the details of his own faith, but in the best methods of replying to the arguments of the infidel. We suppose that, in this instance, people who have gas for sale are the infidels. Following this, the audience had it impressed on them that electricity is something refined for the performance of tasks which have hitherto been done by a grosser medium. It is difficult to find any complete or fit application of the term "grosser" to gas. For most of the tasks for a corresponding amount of work, electricity accounts are of a "grosser" character than gas accounts. On the other hand, gas supplies a "grosser" amount of heat for a given expenditure than electricity; and householders like this. Mr. Beauchamp cites some figures that have been put forward for gas—for example, for low-pressure lighting, 70 c.p. for a consumption of 2¾ c.ft. of gas per hour. Mr. Beauchamp says that average results may be nearer 50 c.p. for 3 c.ft. Quite so. It all depends on the calorific value of the gas; but Mr. Beauchamp does not say so. There are low-pressure inverted burners with which one can comfortably get 25 c.p. per cubic foot of 500 B.Th.U. gas consumed per hour. In the same burners (regulated to the changed condition) using 350 B.Th.U. gas, only 17 c.p. per cubic foot would be obtained. Mr. Beauchamp should have regard to the quality of the gas in a district before making statements which suggest a universal claim by the gas industry for all qualities of gas. Then he speaks of by-passes, and their addition to the consumption, which, he says, may add as much as 25 p.ct. to the consumption. Relatively few consumers use by-passes. We have not one in our offices. He asserts that practical tests have shown the consumption of gas-burners to be as much as 75 p.ct. greater than the asserted consumption. That is positively unkind. It is another way of saying the men of the gas industry are—let us put it politely—perverters of the truth. Mr. Beauchamp works on gas figures being largely laboratory ones, and not practical. We could show him some very fine gas-lighting results which are not from laboratory tests. We wonder what tests they were which credited the gasfilled electric lamps with an efficiency of 1 c.p. per half watt? Has Mr. Beauchamp never heard of the lighting power of electric-lamps declining to figures which in no wise comply with the results of laboratory tests of new lamps? And laboratory tests of new ones have shown us wide variations in the same batch. As to high-pressure lighting, if Mr. Beauchamp and the salesmen he was addressing will pay a visit to Whitehall, the approach to Waterloo Bridge, and other parts of London, they will see something in the way of illumination which can only be described as very fine practical results.

Power.

The next point in the paper refers to electric power; and here, says Mr. Beauchamp, the men of the electricity industry have a chain of selling argument which has little to do with cost. The strongest point is that of convenience; and then there are the possibilities for exact measurement, which has a considerable influence on the study of cutting speeds, tool angles, &c. For small powers and intermittent use, the electric motor has recognized advantages—Mr. Beauchamp might note, even by gas engineers. Excuses succeed as to the retention of very low power rates. When electric power started, very competitive rates had to be adopted in order to get in at all. The past influence has left its impression on policy to-day. "We are far too apt," remarks the author, "to concentrate on the question of relative cost, instead of all-in cost." But the counsellor's voice is one thing; the hard facts that are met with in dealing with the manufacturer quite another matter. Cost does count; and the salesman knows it. As to large business—say, 10 to 100 horse-power—"gas engines on town gas of the smaller sizes, and diminishing in numbers every year," are still encountered, with suction gas or engines of the Diesel class on the larger jobs. The salesman will also be confronted with "the gas company's little tales of cost based upon a certain number of cubic feet per horse-power-hour." Mr. Beauchamp should not deliberately attempt to belittle. The competition is more than that. The gas-engine makers are not turning-out engines at the rate they are doing, or were doing before industrial depression set in, for the mere fun of the thing, or to run themselves into bankruptcy. Just previously Mr. Beauchamp had been arguing that low power costs for electricity were something bequeathed by the past, and are unnecessary. Supposing, he now says, a manufacturer, by putting-in a reciprocating engine, reduces his annual power bill by half, to take an extreme case, it only means half of 2 p.ct. of his total costs of production. It seems to us that in this argument Mr. Beauchamp is forgetting that he has been advising a more liberal view as to actual costs, seeing that, in his opinion, there is no need to cut them too fine. He then falls back once more on the advantages of using electricity. But, whatever is advanced in this respect, the truth is that costs have more persuasive eloquence than all the talk about subsidiary benefits. Every case, however, should be judged on its own conditions as to the form of power it is preferable to adopt. If Mr. Beauchamp is an "engineer" in every sense of the term, he knows this to be true. As to large power business, the author had not much to say. He knows that here electricity is up against a problem that its advocates find difficult of solution. In every line of the power business, given long running and good loads, gas can beat electricity on the ground of economy; and yet in other cases the gas advocates are quite willing to concede that the convenience of the electric drive is a factor that cannot be ignored in connection with light or intermittent loads.

Heating.

Coming to the section of the paper dealing with heating, again it is not cost, but other considerations on which Mr. Beauchamp appears to rely. We like the sentence: "In most of the cases likely to come before us, mere thermal efficiency will not be the deciding factor." "Likely to come before us!" That does not suggest any anticipation on the author's part that electric heating has a chance of becoming universal. Mr. Beauchamp knows, if he does not call the attention of salesmen to them, of the impediments with which electric heating is faced. He believes the industry has an "immense" field for electric heating; and there are the "immense" advantages due to the ability to measure exactly, the facility with which heat can be localized, or even generated within the object to be heated, and incidentals with regard to the absence of combustion and of need of air, to the elimination of ash, smoke, &c. Always the same tale, and the same advice; always reliance on matters outside the cost of operation. So long as electrical salesmen stick to such reliance (as they are compelled to do), the movement to total domestic electrification will be slow; so long as the user has experience of the cost of electric heating during very cold weather (as he is bound to have if he has an electric radiator), the electrical salesmen will find such arguments as Mr. Beauchamp puts into their hands rather ineffective in persuading to a large or rapid extension of the electric method. In order to lower costs, salesmen have been prone to recommend heating appliances far too undersized for the rooms in which they are to be installed, knowing well that adequate sizes with big consumptions would be the most effective means of quickly producing abandonment. We do not know which is the most advantageous to the gas industry—recommendation of electrical appliances that are undersized, or appliances that make the householder's hair stand on end when he is faced with the account. Both are found to be highly effective—from the gas industry's point of view. Mr. Beauchamp gives the electrical salesman some good advice electrically considered. "If," he remarks, "you are trying to sell a radiant fire for use in a bedroom for half-an-hour night and morning, do not start talking about the cost of the unit, and how many units it takes." And, again: "It is not necessary to sell electricity for any purpose at the price of its competitors. You can always get something more on account of its superiority, but how much more depends on circumstances." We are, however, surprised at Mr. Beauchamp putting the following before salesmen: "If you are offering a 2 kw. stove at 1d. per unit, its use costing exactly 2d. per hour, it is well to note that the average gas-fire which you are likely to be up against takes 30 to 35 c.ft., which, at 5s. per 1000, is also about 2d. per hour." At 90 p.ct. efficiency, the 2 kw. electric fire will transmit a little over 6000 B.Th.U. to the room; at 75 p.ct. efficiency, the gas-fire with 35 c.ft. of gas of 500 B.Th.U. will transmit to the room over 13,000 B.Th.U. Do let us be fair in trying to educate the salesmen. Moreover, 5s. per 1000 c.ft. is not the price of the greater part of the gas sold in the country to-day. The price is more in the neighbourhood of 4s., with the therm charge at 9d. and 10d. Perhaps it

has escaped Mr. Beauchamp's notice that there are gas undertakings selling at the present time at 5½d. and 6d. per therm.

Cooking. As to cooking, Mr. Beauchamp had not much to say. There should be hiring-out; and the rate for electricity should be fairly competitive with gas, "although it certainly need not be as cheap as gas." Why not? He thinks that the price per therm divided by eight gives a fair indication of what the price per unit ought to be for cooking. Many undertakings cannot afford to supply electricity at that price. We put the question to Mr. Beauchamp, Why is it that gas heating is going forward with considerable rapidity, while heating by electricity lags so far behind. Why is it, too, that the adoption of electric cooking is so slow; and why are so many electric cookers taken out, and reversion made to gas-cookers? Is it because the consumers only imagine that they are paying more for the use of electric cookers, and that the advantages of electrical operation have not, through their want of intelligence, revealed themselves?

The Year's Prospects. "Electrical Industries" is publishing messages from some of the leading men of the electrical industry regarding the outlook for 1923. When a number of men are asked to express their opinions on a particular subject, it is interesting to note how they view it from several different angles. Mr. C. H. Wordingham will not prophesy as to the future; he urges that co-operation and co-ordination should be the watchwords of those who wish well to the industry. Sir James J. Devonshire refers to various matters, but says that perhaps one of the best features of the Electricity Supply Act of last year is the authority which is conferred upon the Electricity Commissioners by section 22, which deals with charges to the consumers. For the first time in the history of electrical legislation, he says, the veto, given to the consumer by section 31 of the schedule of the Electric Lighting (Clauses) Act of 1899, is abolished. This has hitherto been a stumbling-block to the introduction of a multi-part tariff, for which the industry has so long been seeking. That is Sir James' opinion; but we have not observed that there has been any rush of applications to the Commissioners in this respect. In the judgment of Mr. H. E. Blain, there are signs in a number of industries that trade depression has reached its lowest point, and that things are slowly but steadily improving. Mr. Bernard M. Drake regards as the most pressing need of the electricity industry at the present time a reorganization of the methods of sale of electrical products. From Wolverhampton, Mr. R. B. Mitchell writes that the prospects for 1923, as far as the electricity industry is concerned, are brighter than they have been for a long time. Both that gentleman and Mr. Allen (of Glasgow) are of opinion that this year will see a big advance in connection with the applications of electricity to domestic purposes.

PRESSURE TESTINGS.

A Typical Provisional Prescription of the Gas Referees.

Under the Aldershot Gas (Charges) Order, 1921, the Gas Referees have issued the subjoined special supplementary prescription with regard to pressure testings. It is dated the 18th inst.

The Gas Referees hereby prescribe with regard to the pressure at which gas is to be supplied by the Aldershot Gas Water and District Lighting Company (hereinafter called "the Gas Company") as follows:

PLACES AND TIMES AT WHICH TESTINGS SHALL BE MADE.

The pressure at which gas is supplied by the Gas Company, in any main or in any pipe laid between the main and the meter having an internal diameter of two inches and upwards, shall be ascertained by testings made by the Gas Examiner:

(1) At each testing place prescribed by the Gas Referees for testings of calorific value and purity. A test for pressure may be made at any time, and shall be made on each occasion on which the Gas Examiner visits the testing place for the purpose of other testings.

(2) Testings shall be made at such other times and at such places as the Gas Referees may from time to time prescribe in a Special Notification for the Gas Company, and

(3) Testings shall be made at any time, subject to the preliminary conditions set out below having been first fulfilled, at other places provided for in those conditions, on a request being directed to the Gas Examiner appointed for the district in which the place is situated by:

(*a*) The appropriate Local Authority (or Quarter Sessions),

(*b*) Any five consumers whose premises are situated within a circle of one hundred yards radius, or

(*c*) Any consumer to whose gas meter a service pipe having an internal diameter of two inches or upwards is laid from the main of the Gas Company.

PRELIMINARY CONDITIONS.

The following preliminary conditions shall be fulfilled with a view to avoiding the expense to the Local Authority of having testings made in consequence of complaints which are due to circumstance of a purely temporary or accidental nature.

"A." That the Gas Company shall have been informed not less than seven days previously by the Local Authority or Quarter Sessions or the complaining consumer or consumers (*vide* (*a*) (*b*) and (*c*) *supra*) that there is reason to believe that gas is supplied to any premises, or a particular street or district, at less than the minimum permissible pressure, and has, on request, been afforded reasonable facilities for clearing any obstruction from the service pipe of any consumer concerned.

"B." That the Gas Company shall not have satisfied the complainants that the pressure is, or thereafter will be, at or above the minimum permissible, or alternatively, has not given an undertaking in writing to make such arrangements within two calendar months of the receipt of the information as will ensure the gas being supplied thereafter to the affected premises or district at or above the minimum permissible pressure. The Gas Referees may vary this period of two months after receiving representations from the Gas Company or the complainants as to the extent of the work involved. It shall not, however, be open for the Gas Company to avail themselves of the latter alternative in respect of the same premises or district more than once in any period of twelve months.

"C." That a request be directed by the complainants to the Gas Examiner appointed by the Local Authority (or Quarter Sessions) in whose area the premises, street, or district referred to are situated, to test the pressure at which gas is supplied. With such request there shall be enclosed:

(*a*) A copy of the information to the Gas Company given not less than seven days previous to the date of the request to the Gas Examiner.

(*b*) A declaration that any request made by the Gas Company for reasonable facilities for clearing any obstruction from the service pipe of any consumer concerned has been complied with.

(*c*) A statement that the Gas Company has not satisfied the complainants that the pressure is or will thereafter be at or above the minimum permissible, and has not agreed to make such arrangements within the specified time as will ensure the gas being supplied thereafter at or above the minimum permissible pressure.

PROVISION OF FACILITIES.

In the case of pressure tests on a main elsewhere than at the prescribed testing place, the Gas Examiner shall avail himself of any facilities provided by the Gas Company, which are satisfactory to him for ascertaining the pressure in the main; and in the absence of such facilities, shall make his testing upon the standpipe of any convenient street lamp selected by him, or if no such street lamp is convenient or available, the Gas Company shall give the necessary facilities for the Gas Examiner to make his testing of the pressure in the main by observation as hereinafter provided upon the fittings of a consumer whose service pipe is connected to that main.

In the case of pressure tests on a pipe laid between the main and the meter, having an internal diameter of two inches and upwards, the Gas Examiner shall request the Gas Company to provide facilities for fixing his gauge upon the pipe immediately adjacent to the inlet of the meter, and the Gas Company shall provide such facilities within seven days of the receipt of the request. The arrangement or fitting shall be such that the Gas Examiner may conveniently and immediately attach and use his gauge (or a pressure register when one is specifically prescribed by the Gas Referees). The fitting shall be left available for the use of the Gas Examiner for further testings for a period of three months, or such other period as the Gas Referees direct; but the Gas Company may seal it after each testing, and the Gas Examiner shall note in the Record Book each occasion on which he breaks the seal for a testing. At the end of three months, unless the Gas Referees have directed otherwise, the Gas Company may remove or otherwise deal with the fitting. The Gas Company may, if they so desire, also provide facilities for making pressure tests upon the main to which the service pipe (of two inches internal diameter and upwards) is attached, and the Gas Examiner shall test and report these pressures in addition to those made adjacent to the meter inlet.

TESTING APPARATUS.

The gauge to be used in pressure testings shall, for the present, be a U-tube gauge containing water, with limbs of equal bore, which shall not be less than three-eighths of an inch, and fitted with a scale graduated in divisions of one-tenth of an inch. This scale shall extend to the highest ordinary pressure at which gas is supplied to the testing place or to consumers. One limb of the gauge shall be connected with the gas supply, and the other shall be freely open to the air.

One such gauge, in portable form, shall be provided in each prescribed testing place, for use by the Gas Examiner in making testings elsewhere than in the testing place. This gauge shall be returned by the Gas Examiner to the testing place after use elsewhere. This portable gauge shall be attached to the nozzle or other fitting fixed to the connection or service pipe through or on which the tests are to be made, by means of a union-joint or a

short length of thick-walled indiarubber tubing of not less than three-sixteenths of an inch bore.

A ladder and a short pair of pliers, and other tools likely to be required by the Gas Examiner when taking pressures at lamp columns and for attaching the pressure gauge, shall also be provided by the Gas Company, who shall take the ladder and tools to and from the point where they are required for use by the Gas Examiner.

Reasonable Notice.

When pressure testings are made at places situated elsewhere than at the works of the Company, the Gas Examiner shall give reasonable notice to the Gas Company of the time at which he will attend to make a test, or to verify or inspect the pressure register, in order that if the Gas Company so desire, a representative may be present on any such occasion.

Method of Testing.

The Gas Company shall give the Gas Examiner such information as he may require, for the purpose of carrying out his tests or making his reports, as to the internal diameter and approximate length of service pipes and the internal diameter and approximate length of street mains.

With the -Tube Gauge.

Tests of pressure with the U-tube gauge, whether fixed at a testing place, or attached temporarily to a nozzle or other fitting fixed to the connection or service pipe through or on which the tests are to be made, shall be made in the manner described below.

The portable gauge shall be attached to the nozzle or other fitting by means of stout rubber tubing or flexible metallic tubing. The gauge having been filled to a suitable height with water and the tap turned on gradually in order to avoid "blowing" the gauge, the pressure shall be read on the scale to the nearest tenth of an inch. If the gauge is more than twelve feet above the level of the ground or roadway immediately outside or below the place where the testing is made, a deduction of one-tenth of an inch shall be made from the gauge reading for every complete twelve feet which the gauge is above that ground level, and the figure so obtained shall be deemed to be the pressure of the gas at that time and place. The Examiner shall report it accordingly in inches to the first place of decimals, on the form of report of which a specimen is given in Appendix I. of the Special Provisional Prescription.

When the testing of pressure in a main is made, in the absence of other facilities, upon the fittings of a consumer whose service pipe is connected to that main, the Gas Examiner shall attach the gauge to any convenient burner fitting supplied through that service pipe; but before making his reading of the gauge in the manner prescribed above, he shall see that all taps supplied from the service pipe are closed, so that there is no flow of gas through the pipe at the time, and shall verify this by means of the test dial of the meter. In other respects the testing shall be made and reported exactly as described above.

When the Gas Examiner is required to test the pressure of the gas in a pipe laid between the main and a consumer's meter (the pipe having an internal diameter of two inches and upwards), he shall note the size and length of the pipe, obtaining the information from the gas company if necessary. He shall then have the gas lighted at the consumer's appliances, and during the testing of pressure shall allow gas to pass through the service pipe at an hourly rate, as determined by the test dial of the meter, not in excess either of the rated capacity of the meter, *i.e.*, 6 c.ft. per hour per "light," or of the approximate figure in the following table (whichever is the lower rate).

Length of Pipe in Yds.	50	100	150	200	250	300	500	1000
Internal Diameter of Service Pipe.	Cubic Feet per Hour.							
2 in.	500	350	300	250	225	200	100	
3 ,,			800	700	600	550	400	
4 ,,				1400	1300	1200	900	
5 ,,				2400	2100	2000	1500	
6 ,,					3500	3000	2500	1500
7 ,,						4000	3000	2000
8 ,,							4500	3000

For lengths exceeding the above, approximate figures will be furnished to the Gas Examiner by the Gas Referees when called for.

Meters are rated either for the number of "lights" of 6 c.ft. per hour, for which they are intended, or, in the case of newer meters, by numbers according to the following scale, viz.:

No. 7	540 c.ft per hour.
,, 8	720 ,, ,,
,, 9	900 ,, ,,
,, 10	1200 ,, ,,
,, 11	1800 ,, ,,
,, 12	3000 ,, ,,

With the Pressure Register.

Until the Gas Referees direct otherwise, they hereby prescribe that testings shall be made with a pressure register at the testing places from the date upon which they prescribe the use of a recording calorimeter. They will also prescribe it for other positions in cases in which intermittent tests with the U-tube gauge appear to them to be inadequate, or effective only if the Gas Examiner's time is given to them to an inordinate extent, or at inconvenient hours.

Method of Using.

When fixing the record chart, the Gas Examiner shall adjust the pen so that the reading on the chart corresponds with the reading as determined by the U-tube gauge, and shall also check that the pen is on the zero mark of the chart when the gas is turned off. The adjustment may be effected by the addition or extraction of water in the case of water float registers of approved types. He shall see that the bell and pen attached thereto move freely with any variations of pressure, which may be done by the partial or complete closing and opening of the gas tap. He shall wind the clock before affixing a new record chart, and on any other occasion as he may decide. Before removing the chart he shall compare its record with that of the pressure found by the U-tube gauge, and should these pressures vary by not more than two-tenths, the records upon the charts shall be used by him for the purpose of reports of testings of pressure, and he shall apply corrections if necessary to cover the time at which he shall decide that the discrepancy commenced; such time not exceeding one-half of the time during which the record chart in question has been in action. If the discrepancy exceeds two-tenths, he shall discard the record chart and make his testing by means of the U-tube gauge. The Gas Company shall obtain the sanction of the Gas Referees and cause the pressure register to be repaired with all speed, or substitute a new one in its place, and shall notify the Gas Referees at the time the register is taken out of action and also when replaced or a new one substituted. The record charts shall be initialled and dated by the Gas Examiner. He shall note on the record chart, above the line made by the pen, the highest pressure recorded on the chart, and on the lower portion of the chart he shall note the lowest pressure similarly recorded; and in cases where the pressure shown is below the minimum, he shall note the time and date upon the record chart.

On Pipes Between the Main and a Consumer's Meter.

When the pressure register is used to make continuous tests of the pressure in a pipe laid between the main and the consumer's meter (such pipe having an internal diameter of two inches and upwards), the flow of gas shall not be specially controlled, but shall be according to the normal requirements of the consumer.

Before the first occasion of making continuous official tests with the pressure register elsewhere than at a prescribed testing place, the Gas Examiner shall satisfy himself that the preliminary conditions "A," "B," and "C" have been complied with. When pressure tests upon the same pipe are again required within twelve months of the first occasion, the Examiner shall satisfy himself that the preliminary conditions "A," "C" (*a*) (*b*) have been complied with.

An arrangement may be made between the consumer and the Gas Company whereby the special fitting may be left permanently in position for the purpose of obtaining information for the use of the Gas Examiner, the consumer, or the Gas Company, or the Referees may order that it remain in position; but before making use of this fitting for the purpose of obtaining an official record or test, the Gas Examiner shall proceed as laid down in the preceding paragraph.

Within seven days of the receipt by the Gas Company of a request from the Gas Examiner, the Company shall provide facilities for fixing the pressure register as laid down for the use of the U-tube gauge, which facilities shall, if necessary, include a stand or shelf in a convenient place as indicated by the Examiner. These facilities shall be left available for the use of the Gas Examiner, and be dealt with as if provided for the U-tube gauge.

On any Main.

Facilities for fixing the pressure register shall be provided by the Gas Company, as laid down in the preceding paragraph. When the register is connected to the fittings of a consumer for ascertaining the pressure in any main (as in the case of the U-tube gauge) the Gas Examiner shall verify by inspection of the meter index that no gas has been consumed through the service pipe during the whole of the time each record chart has been in use. He shall note the readings of the meter on the record chart.

Apparatus.

In the case of a pressure register being prescribed for continuous use at the prescribed testing place, it shall be provided and fixed by the Gas Company in a place convenient for the Gas Examiner's use.

The pressure register or continuous pressure recorder shall be of a type approved by the Gas Referees, shall have a clock capable of going for eight days at one winding, and shall be suitable for pressures up to the maximum distributing pressures at which gas is supplied to the ordinary consumers of the Gas Company. It must be furnished with a supply of special ink, a spare pen for renewal, and a supply of record charts, each ruled for a period of seven days. It must have attached to it a U-tube gauge for verifying readings. When in use, the pressure register must be completely enclosed in a case or cover or partitioned space under lock and key in charge of the Examiner. When in use at a permanent official testing place, the register shall be attached to the gas supply by means of a flexible metallic tubing or a fixed pipe connection of not less than three-sixteenths of an inch bore, and shall be so set up that the charts may be open to inspection through glass at any time by the staff of the Gas Company.

NATIONAL GAS COUNCIL.

Meeting of the Central Executive Board.

A Meeting of the Central Executive Board of the National Gas Council was held on the 10th inst., at No. 30, Grosvenor Gardens, S.W.—Mr. D. Milne Watson in the chair.

THERM INQUIRY.

The third day's hearing by the Departmental Committee on the previous day was discussed.

GAS OIL.

It was reported that the Council had been in communication with the National Benzole Company with regard to the supply of Polish Galician gas oil at favourable prices, details of which had been circulated to the various districts of the Council.

TAR.

It was announced that copies of the amended specifications for road tar as issued by the Ministry of Transport had been circulated to members of the Board, incorporating many of the suggestions made by the Council to the Ministry.

RAILWAY RATES—COAL CLASSIFICATION.

A conference was reported between the Mining Association and the Federation of British Industries on Dec. 13 last, when the Council were represented. The Mining Association asked that the traders should join them in going to the Rates Tribunal to ask for a reversal of the previous decision of the Association in October last—that one class only should be adopted for coal, coke, and patent fuel—and for a new classification to be established. The Mining Association were asking that coal for export should be classified separately at lower rates. They admitted, however, that this course would not be beneficial to the gas industry, and that the price of gas coal might be increased thereby. It was stated that it was practically certain that the Federation of British Industries would not agree to the proposals of the Mining Association in this respect. Certain resolutions had been passed by the Sub-Committee of the Federation of British Industries, but these could not be divulged at present.

GAS REFEREES—REVISED DRAFT SPECIFICATION FOR PRESSURE TESTING.

It was reported that the revised draft specification had been circulated to members of the Board. It had previously been submitted to the Committee of the Council dealing with this matter, and no objections had been made thereto. After considerable discussion, certain points were raised in connection with the draft, which it was decided to refer back to the Committee.

INSPECTION OF CALORIMETERS.

A question was raised as to the periodical inspection, adjustment, and standardization of calorimeters prescribed by the Gas Referees. In the event of an instrument giving low readings by reason of internal corrosion, leakage, or other cause, the gas undertaking might be liable to heavy penalties. It was known that calorimeters required frequent examination and re-standardizing to ensure their continued accuracy. It was agreed to refer this matter to the Committee of the Council dealing with the Gas Referees' prescriptions.

DIVERSION AND STOPPING UP OF HIGHWAYS—RESPONSIBILITY FOR RELAYING MAINS.

It was reported that the attention of the Council had been drawn to schemes for road improvements which were now in operation in various parts of the country, by which highways were being diverted, the old highways being stopped up and reverting to private ownership. The question raised was as to the position of public utility undertakings which have mains under the present roads. It was decided to join with the water interests in obtaining Counsel's opinion on the rights of the undertakings in such cases, and the responsibility for the cost of transferring the main to the new road, where necessary, &c.

SOUTH STAFFORDSHIRE MOND GAS (POWER AND HEATING) COMPANY.

It was reported that certain gas undertakings in the affected area had been apprehensive lest the repeal of section 48 of the above Company's Act of 1901, which their new Bill sought to effect, might possibly permit the Company to supply gas for illuminating purposes in the statutory district of a gas undertaking. The solicitors to the Company had, however, given an assurance that the repeal would only apply to gas sold in bulk as contemplated by the new Bill, and that gas undertakings in the district would not be prejudiced thereby.

It was agreed that the Council should carefully watch this matter.

SOUTH WALES ELECTRICAL POWER DISTRIBUTION COMPANY ACT, 1922.

The first application for a "Consent" under section 14 (d) of the Act was reported to have been made to the Ministry of Health, and it was stated that the local gas company had now agreed to oppose the granting of such "Consent."

It was decided that the Council should watch the matter in conjunction with the gas company concerned.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Nelson Corporation Gas Undertaking on Saturday, Jan. 13.

The party assembled at the Brierfield Works, being met at the entrance by the Engineer and Manager, Mr. James Mitchell On reaching the exhauster-house, all signed the visitors' book. The Chairman of the Gas Committee, Alderman Fell, addressed a few words of welcome, and said that it was the first occasion they had had visitors to their works who were connected with a technical association like theirs, and he gave them a hearty welcome. At Brierfield, many improvements had been made, and he called attention to the improved sidings, telpher plant, coke separator, and their high-pressure lighting.

THE BRIERFIELD WORKS.

The party were then divided into groups and conducted round the works. Messrs. M'Farlane, Bennett, Barrow, and Glover were the guides, and they were assisted by Mr. G. P. Mitchell, Engineer at Blackburn, and the Engineer and Manager.

PURIFIERS.

During the winter months great difficulty is experienced at the Brierfield Works owing to the existing purifying plant being inadequate to cope with the maximum daily make of gas. The existing purifiers (installed 1900) consist of four rectangular cast-iron boxes, each measuring 30 ft. by 20 ft. by 5 ft. 9 in. deep, supported on cast-iron columns and rolled steel joists and girders. The area of the boxes is only capable of dealing with a maximum daily make of one million c.ft.

One can realize the unnecessary labour, including overtime, spent on continuous changing of the boxes, together with the risk of foul gas getting on the town. During last year 35 boxes were changed, the cost amounting to £525. Despite the fact that the purifiers are fitted with steam pipes, to eliminate extra labour, in the winter months last year the cost of purification was one penny per 1000 c.ft. against a statistical average of 0·25d. per 1000 c.ft.

Reviewing the present working conditions, it can readily be grasped that the prevailing conditions are in short due to the want of surface contact. To meet the future requirements two new purifiers each 40 ft. by 40 ft. by 5 ft. 9 in. deep have been erected, and the existing four boxes will be converted into two large boxes, and work in series with the new ones. This arrangement will give a purifying area sufficient for a daily make of 3 million c.ft., which will be adequate for some considerable time to come. In addition to the new boxes, a reversible valve has been included which will aid to more efficient working of the purifying plant.

Owing to the heavy nature of the structure and the treacherous condition of the ground, much consideration had to be given to the foundations; and the only satisfactory method of overcoming the difficulty was to have these piled.

In the past the method of handling the oxide has been a most primitive one—viz., by means of a hydraulic hoist and hand barrows. With the house extension, more modern plant has been allowed for in the form of a monorail, supported by the roof, which will traverse both the old and new houses. In conjunction with this monorail an electric telpher plant will operate for transporting purifying material. In view of the economical working of the telpher plant the monorail has been extended throughout the yard for the purpose of loading and discharging the purifying material, and for dealing with the coke and other materials under delivery.

In justification for the introduction of these extensions, it may be mentioned that the constant changing of boxes, at an average cost of labour of £15 per box, will be obviated, and that the saving on these charges will be quite 60 p.ct.

RAILWAY SIDING.

The main object of projecting this scheme has been to overcome the expensive method of handling coal hitherto in vogue. The practice has been to transport it by means of a tramway system; small bogies running between the siding adjoining the works and the coal store, which method had many difficulties during the winter months. By this system (even during the period of maximum carbonization) it was necessary to limit the number of men employed, for the satisfactory running of the bogies. Furthermore, owing to the limited siding accommodation, it was found impossible to augment the stocks, however pressing the need, without incurring heavy overtime charges.

In addition to the coal-handling scheme, two bays have been provided for, which will facilitate the loading of coke, the loading and discharging of oxide and other materials under delivery. For the purpose of dealing with the inward and outward traffic, an electric capstan has been installed at the entrance to the coal store, together with bollards distributed over the yard. To expedite the discharge of coal wagons, two hydraulic tippers have been installed, together with a hydraulic pump and the necessary electrical equipment. In the past, no facilities have existed for the proper weighing of coal received, which defect has been remedied by the introduction of a 30-ton weighbridge.

As compared with an average cost of 1s. 1d. per ton for labour over the last 12 months of working on the old method, the cost of the necessary labour since the siding was laid down has already

dropped to 3¼d. per ton—which saving, on a year's consumption of 24,000 tons, will amount to £975. When complete arrangements have been made for having the wagons delivered into the yard, a further saving will be effected. It should be noted that the laying of the new siding from the Railway Company's line into the works entailed the regrading of the roadway adjoining the gas-works boundary wall.

Aerial Ropeway.

Until a year ago it was the custom to deposit ashes on the slope above the canal at the Brierfield gas-works; but owing to objection taken by the Leeds and Liverpool Canal Company, due to the treacherous strata of the ground, the practice has had to cease. For the purpose of dealing economically with the refuse, the Corporation have acquired 6½ acres of land on the other side of the Leeds and Liverpool Canal, which it is proposed to use as a dump.

Having in view the very short length and very light capacity, an aerial ropeway on the to-and-fro system has been installed, which consists of a track rope 185 yards long; and the bucket, containing about 4 cwt. of material, is hauled forward and backward by electric driving gear, the time required being approximately 2 minutes, to a point on the track line which engages with a movable trip frame and automatically empties the bucket. At the extreme end of the track there is a complete set of tension gear, including rope sheaves, balance weight, &c., for adjustment.

The disposal of the ashes by this means has cut out the heavy expense of hired team labour formerly required to remove them to that part of the yard previously indicated, to other parts of Brierfield and district, wherever tipping room could be found, and often to the Corporation tip at Nelson, 1½ miles away. Some idea of the value of the improvement will be gathered when it is pointed out that by the use of this plant, as much material can be disposed of by two men in one hour as would have occupied two carts for a whole day. This means that by an expenditure on manual labour of £34, a year's team-labour costs of £309 would be dispensed with—a gross saving of £275 per annum.

Coke Recovery Plant.

A further scheme for the prevention of needless waste is that for the recovery of a high percentage of usable coke always found in the ashes from the furnaces of regenerative retort settings. It has long been a matter for regret that this usable fuel should go unsalved, and many have been the attempts to find a solution to the problem. Hand picking, as tried here on more than one occasion, is hopeless; and various types of machinery tried at other towns have not proved successful. Now, however, machinery has recently been introduced which accomplishes the salvage to a remarkable extent, and is known as the "Columbus" coke separator. This plant is yielding results which are attracting the attention of gas engineers throughout the country.

The pan-ash breeze is fed into a hopper, from which it is elevated to a rotary screen, which throws down the dust, ejects those pieces which are too large, and passes on the remainder to a washing tank. Under this tank is a mixture of loam and water, which is adjusted to the right specific gravity to enable the coke to float readily on its surface, allowing the clinker to sink. An Archimedean screw elevator collects the coke from the top of the liquid, carrying it to the extremity of the apparatus and ejecting it. Beneath the upper screw elevator is a second of exactly similar nature, which collects the clinker from the bottom of the tank and ejects it in a separate heap. The success of the invention lies in the proper adjustment of the specific gravity of the separating fluid, and this is a process which is easily operated by regulating the inflow of loam liquid, the specific gravity being read off a hydrometer. The whole plant can be operated by one man, and requires only a 4 H.P. electric motor to drive it. From an inspection of the machine and specimens of the sorted products, it is evident that the separator is as nearly perfect as is possible. The coke, not being in contact with the water more than a few seconds, is remarkably dry.

It is claimed for this machine that 30 p.ct. of the ash is recovered in the form of usable coke, which, with a coal consumption of 24,000 tons, represents the saving of 540 tons a year which would otherwise be deposited on the refuse dump. If this reclaimed fuel were used exclusively for a works producer and boilers, the same weight of fresh coke would be liberated for sale; and at the very low value of £1 per ton, a gross saving of £540 would result. At the same time the land acquired for use as a refuse dump and served by the aerial ropeway would give the necessary accommodation for a proportionately longer period.

The Glover-West vertical retorts were seen in operation at both the Brierfield and Nelson works. The high-pressure lighting plant and the Bryan Donkin Rateau turbo booster (350,000 c.ft. per hour) are features at the Nelson works, in addition to the special plant mentioned at the Brierfield station.

TEA AND SOME SPEECHES.

Tea was served at the Station Hotel, the Gas Committee being represented by Alderman Fell (Chairman), Councillor Gibson (Deputy Mayor), Councillors Riley and Smith, and Alderman Townsley.

Mr. J. H. Clegg (Burnley) moved a vote of thanks, and in doing so said it gave him much pleasure to comply with the request of the President. That afternoon had been like a home-coming to him, as he was formerly on the staff there; and he had taken particular interest in noting the developments that had been made by the various engineers. Nelson was a modern town, and the Gas Committee very progressive. The works were built on a hill side, and the natural site had been utilized to the full in the general lay-out of the works.

Mr. R. Prince (Heywood) seconded the motion, and remarked upon the clean and tidy condition of the works.

The President (Mr. G. Dixon, of Lancaster), in a humorous speech, congratulated the Gas Engineer and his Committee upon the works and plant, and said he thought that Mr. Mitchell had lived so long in Nelson that he could be considered a Nelson man. He thought that the Engineer had adopted the Nelson motto, "England expects that every man, &c.—" even if he had come from over the Border.

Alderman Fell, in reply, said they were pleased to have the opportunity of showing the Association their works; and they were quite prepared to receive any criticism, which, if they were in agreement, they would be pleased to adopt. Their aim was to embody all improvements that would tend to cheapen gas.

Alderman Townsley mentioned the honour conferred by the visit. He thought their visitors had come with a distinct idea of gaining knowledge; and he hoped that they would have profited by the visit. He had thirteen years' experience; and during that time he had always noticed the freedom and goodwill displayed by members of the gas profession. They were always prepared to show anything they had discovered.

Mr. Mitchell (Nelson) said that at Brierfield they intended to concentrate, as they were unable to extend at the Nelson works. It was no easy task to follow his predecessors; but he hoped that before long they would be able to reduce their purification costs, also that their coke washing was going to be a paying proposition.

Travelling Expenses.

The President reported at this stage that the following towns had granted the travelling expenses of their members to the meetings of the Association: Runcorn, Nelson, Stalybridge, Ormskirk, Burnley, Hyde, Radcliffe, Blackburn, and Liverpool. Other towns were considering the question at future meetings of their committees.

PUBLIC LIGHTING.

The paper on this subject, by Mr. E. Burke, of Accrington, having been published in the Technical Press [see "Journal" for Jan. 10, p. 85], was taken as read.

Discussion.

Mr. J. Alsop (Bolton) asked what was the age of the checkers. What were their prospects when they had reached man's estate, the rate of pay, and hours worked?

Mr. Burke said they were aged 18 to 20, and became supernumerary lamplighters (they took the place of the lamplighter when on holiday); and when of the required age, they became permanent lamplighters, with the chance of becoming inspectors, &c. The hours of 11 to 12 midnight were reckoned as 2½ hours, and they started correspondingly late the following day.

Mr. J. T. Haynes (Bolton) thought with the author that high-pressure lighting was the best advertisement that a department could have, and that this side should be pushed far more than it had been of late. It had been very interesting to note that they had made some attempt to deal with this particular matter at Nelson; and he wondered how far Birmingham had developed high-pressure lighting.

Mr. Burke agreed that high-pressure lighting ought to be more considered. He thought that the true costs were hidden, and that the natural tendency was for a low-pressure superheated burner. He could not give any figures, as they had been held as private.

Mr. Mitchell (Nelson) said he had very often been ashamed of the public lighting in various places, and it did not speak well for the industry; but the fault was invariably because public lighting was in the hands of outside bodies, who were not interested in the gas industry. A great deal could be done with low-pressure burners; but high-pressure, either for light, consumption, or cost, showed better results. The secret of the success of the lighting at Nelson was a short mantle, and a full one. All high-pressure lamps should be taken down and thoroughly overhauled each year.

The author pointed out that it was not always an advantage to have a high-priced mantle, because while it might last longer without breaking, it was giving a poor light towards the end of its life. The cheaper mantle broke; but the lamp and burner then got attention and were cleaned more often, and gave a better light on the whole.

Mr. G. B. Dixon (Lancaster) thought the paper was a very good one, and that the question of lighting should be given greater attention. Too often the engineer was busy with carbonizing, distribution, and other items, and the lighting side of his business stood in danger of being neglected. Then, again, the fact that public lighting was dealt with by a special committee was in some cases to the disadvantage of the department and of the town.

Mr. D. T. Livesey (Stretford) asked what was the number of the staff dealing with public lighting?

Mr. Burke said the staff consisted of eleven lighting inspectors and about three clerks.

The author then dealt with the correspondence that had appeared in the Technical Press regarding the Horstmann controller.

Mr. Harrison (Accrington) spoke in strong terms against the lighting being in other hands than the gas department.

Mr. J. H. Clegg (Burnley), Junior Vice-President, took the chair at this point. He said that where suitable mains were laid, high-pressure lamps should be installed on account of their high efficiency, for they were in themselves an advertisement for gas. Electricity could not compare with gas for penetration in case of fog. He also spoke of the need for taking down and overhauling lamps annually.

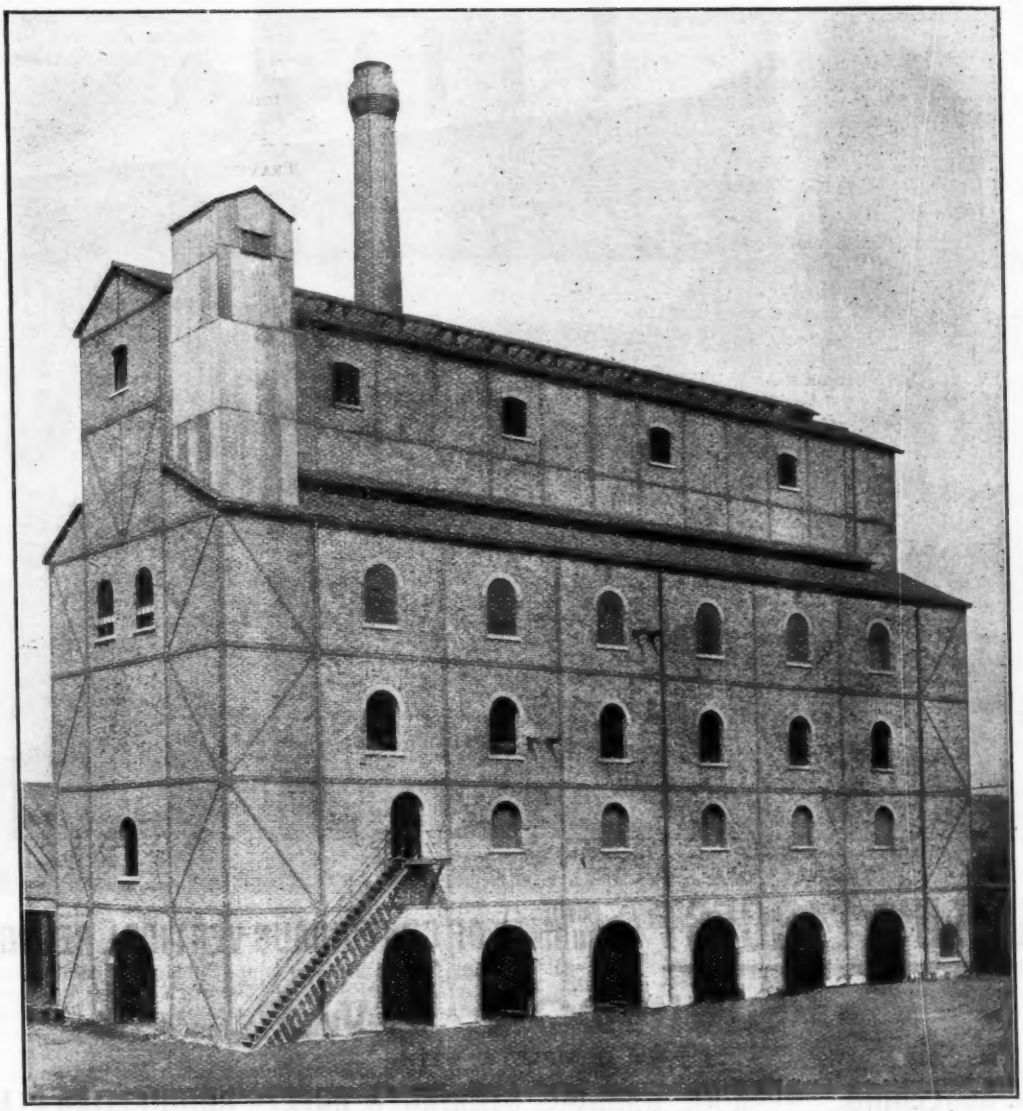
Mr. D. T. Livesey moved, and Mr. Holliday (Blackburn) seconded a vote of thanks to the author, after whose reply the meeting was brought to a close.

W-D

WOODALL-DUCKHAM VERTICAL RETORTS

FIRST IN 1903 — FOREMOST IN 1923

The WOODALL-DUCKHAM VERTICAL RETORT & OVEN CONSTRUCTION CO.(1920) LTD.



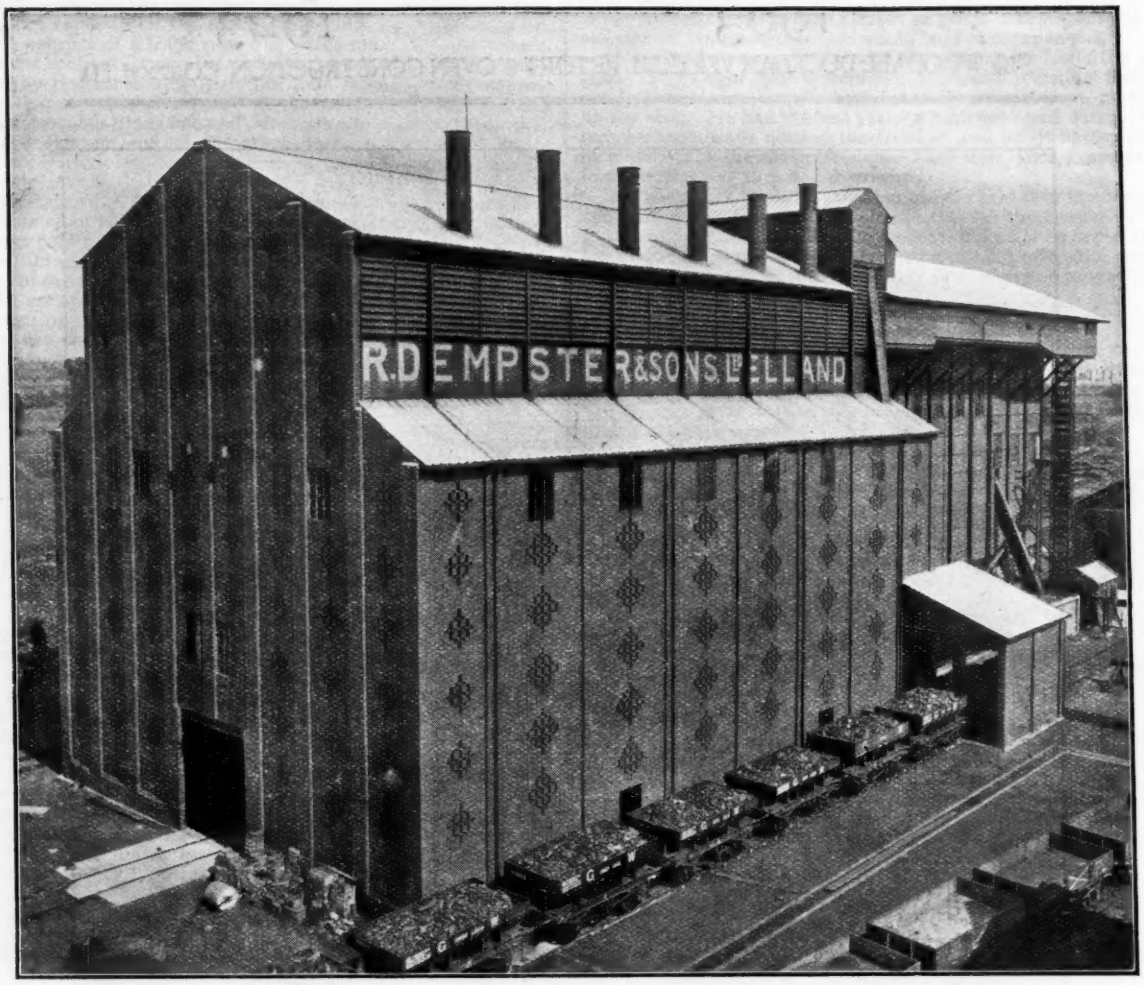
WALLASEY (2nd Installation)

For all particulars apply to

The WOODALL DUCKHAM CO.
52 GROSVENOR GARDENS. S.W.1.

Telephone: 9272 VICTORIA *Telegrams:* RETORTICAL, SOWEST

"DEMPSTER-TOOGOOD" SYSTEM OF (STEAMED) CONTINUOUS VERTICAL RETORTS



WORLD'S LARGEST (PRIVATE INSTALLATION) OF CONTINUOUS VERTICAL RETORTS.

SWINDON G.W.R.

COMPLETE WITH

COKE-SCREENING, BREAKING, WASHING, STORING, & BREEZE BRIQUETTING PLANT.

ROBERT DEMPSTER & SONS, LTD.,

ELLAND.

Wire: "DEMPSTER," ELLAND.

'Phone: ELLAND 261. PRIVATE BRANCH EXCHANGE.

GAS-WORKS EXTENSION AT WALLASEY.

A Progressive Undertaking.

On Thursday last, the completion of the new works of the Wallasey gas undertaking was celebrated in the presence of the Mayor, members of the Council, officials, representatives of neighbouring gas authorities, and others. Wallasey, now a county borough, possessing a beautiful Town Hall and gas-works of the first order, is situated on the Cheshire side of the River Mersey. It includes within its area the well-known districts of Seacombe, Egremont, and New Brighton. Thousands of its people are workers in the City of Liverpool, which occupies the Lancashire side of the river. The gas undertaking of Wallasey began its career 42 years ago. Its growth has been continuous, and particularly so under the skilful management of Mr. J. H. Crowther, who has held the office of Engineer for 32 years. Two years ago a great extension of the works was begun; and it was the completion of the new plant that gave occasion to the gathering last Thursday. The party assembled at the Town Hall.

Leaving the Town Hall—a building of which Wallasey people are justly proud—the visitors were speedily transported by special motor cars to the gas-works, where Mr. Crowther, with his son (Mr. Edward Crowther) and Mr. T. Cook (the Assistant Engineer), was ready to receive them and show all of interest about the works. The first business was to unveil a tablet recording the purpose of the day's proceedings. The Mayor (Alderman W. S. Chantrell, J.P.) called upon Alderman A. H. Evans (the Chairman of the Gas Committee) to perform this ceremony, and declare the new works open.

Alderman Evans said it was his duty to declare the extension, which was practically a new gas-works complete with all the necessary auxiliary plant, open. He hoped the new works would be of lasting benefit to the people of Wallasey, and be a credit to the Gas Committee and Corporation, as well as to the town to which they were proud to belong. Mr. Evans then unveiled the tablet, on which was the following inscription:

> "County Borough of Wallasey. Alderman W. S. Chantrell, J.P., Mayor. This additional complete section of works, constructed during 1920-1922, was opened by the Chairman of the Gas and Water Committee (Alderman A. H. Evans). J. H. Crowther, Engineer. January, 1923."

The company then moved to the retort-house to see a truck of coal gripped by machinery and tippled over until its 10 tons had poured out, after which it was quietly restored to its normal position on the railway. Mr. Evans manipulated the electrical device by which this was done. Twenty wagons can be unloaded in this quiet fashion in one hour, which is more than one elevator can handle.

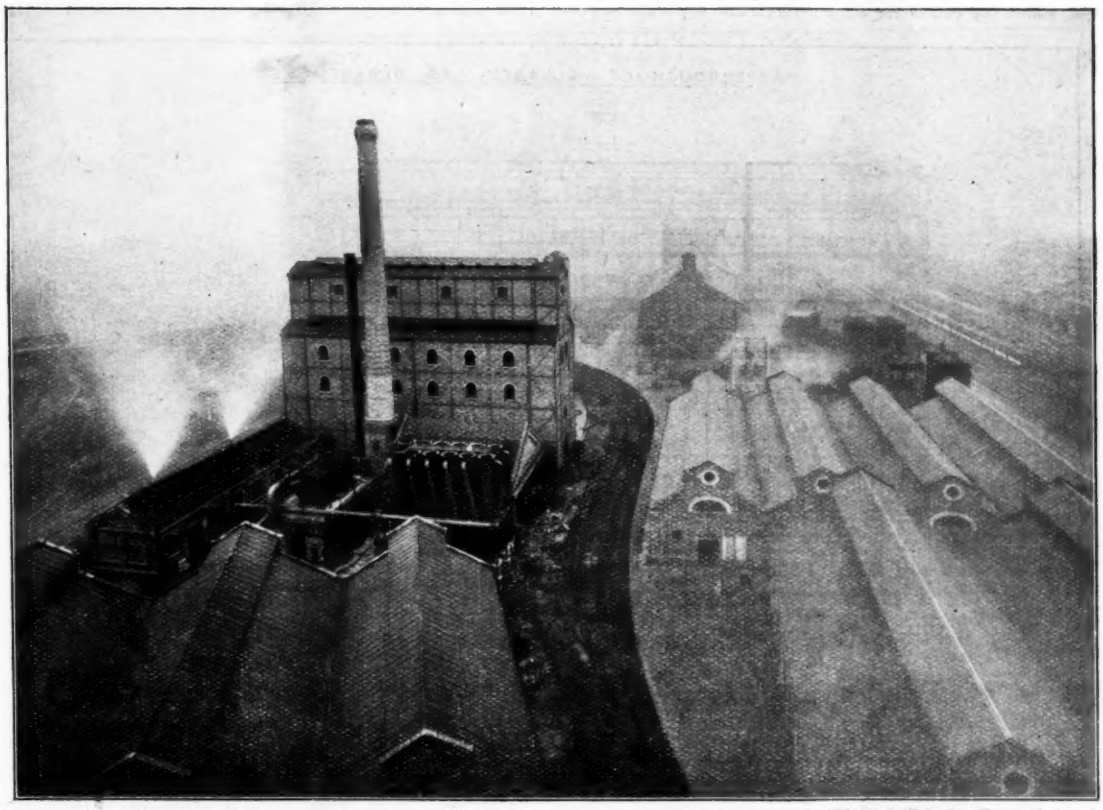
DESCRIPTION OF THE GAS UNDERTAKING AND THE WORKS EXTENSIONS.

[From an illustrated brochure prepared for the occasion.]

Founded in 1860 by the then Wallasey Local Board of Health, the municipal gas undertaking has steadily continued to extend the scope of its work as the demand for gas has increased with the rapid growth of the district. Previous to the war, the output of gas doubled itself every decade; and from time to time the works were added to in order to cope with increasing demands. The most recent of these pre-war additions, consisting of a vertical retort-house of a nominal daily output of 1½ million c.ft. of gas, was completed in 1914.

At the termination of the war, the Gas Committee were faced with the necessity of again increasing their manufacturing plant. Acting on their instructions, the Engineer and Manager prepared plans and estimates for an enlargement of the works to meet this necessity; and, following on permission to raise the required capital, the present extension was put in hand in 1920.

One of the chief considerations determining the type of plant was the somewhat restricted ground space available. This, with economy in running costs, and convenience of arrangement and working, decided the Committee to place with the Woodall-Duckham Company, Ltd., the major contract for a plant to discharge, crush, elevate, and carbonize a nominal 120 tons of coal per day, giving a daily gas output of 1½ to 2 million c.ft.



[*Photos. by Priestley, Egremont.*

VIEW OF WORKS FROM No. 4 HOLDER.

Contracts for auxiliary plant for steam raising, coke handling, and for cooling and cleaning the gas were entered into with various other firms; so that this section of the works is entirely self-contained and complete.

Coal wagons are drawn by an electric capstan from railway sidings into a rotary wagon tippler, which overturns the wagons, discharging the coal into a hopper immediately beneath the rails; the complete operation occupying three minutes only. A jigging screen passes the large coal to the crusher, but screens out the small, which rejoins the broken coal from the crusher at the gravity bucket conveyor below. A second jigger at the base of a smaller hopper built beside the coal hopper feeds coke to the gravity buckets when required. These hoppers and jiggers, the crusher, and the filler for the elevator are housed in a concrete pit, of which the greatest depth is 27 ft. 6 in., width 25 ft. 6 in., and length 40 ft., and which has been arranged to permit of duplication of the plant therein if required at any future date. The conveyor, which is some 430 ft. long, elevates the broken coal to a height of 70 ft. above ground level, at a rate of 50 tons per hour, and deposits it in the steel hoppers from which the retorts are supplied. There are six beds of four 25 ft. retorts. The coke from the discharging chambers is removed at two-hourly intervals in barrows; and that for the producers is elevated by the gravity bucket conveyor to hoppers, which alternate with the coal hoppers. A waste-heat boiler has been included.

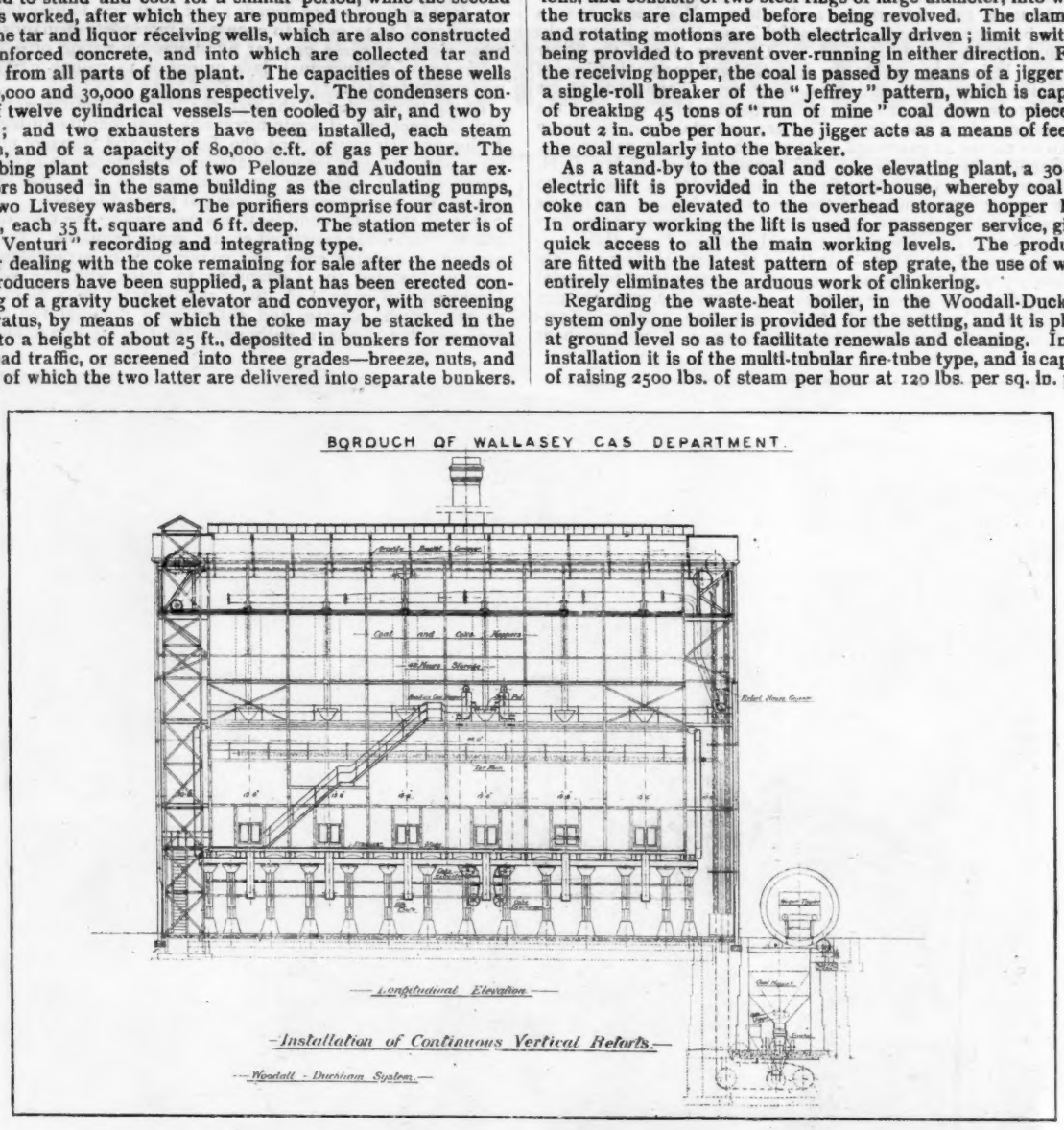
The hot tar circulated through the hydraulic mains, to dissolve the heavy pitch which would otherwise be deposited there, is drawn from, and returned to, one of two small reinforced concrete tanks, by means of a steam pump. The contents of the working tank are added to by tar and liquor from the condensers. After working for 24 hours, the contents of the tank are allowed to stand and cool for a similar period, while the second tank is worked, after which they are pumped through a separator into the tar and liquor receiving wells, which are also constructed of reinforced concrete, and into which are collected tar and liquor from all parts of the plant. The capacities of these wells are 10,000 and 30,000 gallons respectively. The condensers consist of twelve cylindrical vessels—ten cooled by air, and two by water; and two exhausters have been installed, each steam driven, and of a capacity of 80,000 c.ft. of gas per hour. The scrubbing plant consists of two Pelouze and Audouin tar extractors housed in the same building as the circulating pumps, and two Livesey washers. The purifiers comprise four cast-iron boxes, each 35 ft. square and 6 ft. deep. The station meter is of the "Venturi" recording and integrating type.

For dealing with the coke remaining for sale after the needs of the producers have been supplied, a plant has been erected consisting of a gravity bucket elevator and conveyor, with screening apparatus, by means of which the coke may be stacked in the yard to a height of about 25 ft., deposited in bunkers for removal by road traffic, or screened into three grades—breeze, nuts, and large, of which the two latter are delivered into separate bunkers.

framed retort-house, panelled with brickwork; the roof being of slates and patent glazing, to give ample light to the interior. The house is at right angles to one of the works sidings to which coal is brought in trucks; these being emptied into the large receiving hopper by means of the rotary tipper. This is capable of dealing with wagons having a net load of up to 13 tons, and consists of two steel rings of large diameter, into which the trucks are clamped before being revolved. The clamping and rotating motions are both electrically driven; limit switches being provided to prevent over-running in either direction. From the receiving hopper, the coal is passed by means of a jigger into a single-roll breaker of the "Jeffrey" pattern, which is capable of breaking 45 tons of "run of mine" coal down to pieces of about 2 in. cube per hour. The jigger acts as a means of feeding the coal regularly into the breaker.

As a stand-by to the coal and coke elevating plant, a 30-cwt. electric lift is provided in the retort-house, whereby coal and coke can be elevated to the overhead storage hopper level. In ordinary working the lift is used for passenger service, giving quick access to all the main working levels. The producers are fitted with the latest pattern of step grate, the use of which entirely eliminates the arduous work of clinkering.

Regarding the waste-heat boiler, in the Woodall-Duckham system only one boiler is provided for the setting, and it is placed at ground level so as to facilitate renewals and cleaning. In this installation it is of the multi-tubular fire-tube type, and is capable of raising 2500 lbs. of steam per hour at 120 lbs. per sq. in. pres-


BOROUGH OF WALLASEY GAS DEPARTMENT.
Longitudinal Elevation.
Installation of Continuous Vertical Retorts.
Woodall - Duckham System.

The bunker for large coke straddles a railway siding equipped with an electric capstan, so that wagons may be readily loaded with screened coke.

Reinforced concrete forms the yard surface, and has also been used for lining the coke storage hoppers, in the construction of the coal-crusher pit, of the tar and liquor wells, of the pump-house roof, and of the condenser foundations. Electric power has been adopted for driving the coal and coke handling plant; the switchboard being installed in the exhauster house. In addition to the waste-heat boiler, a house containing three direct-fired Lancashire boilers, burning coke breeze, occupies part of the site. These and the waste-heat boiler supply practically the whole of the steam used on both the new and the existing works.

Embodied in the new section of the works, and forming a part of the general scheme, are three pressure boosters, of the steam-driven rotary type. During the daily recurring periods of heavy demand, these deliver gas at a pressure of 5 lbs. per sq. in. *via* some five miles of solid drawn steel mains, with welded joints, to the district governors. The boosters are housed in the same building as the exhausters.

In designing this section of the works, provision has been made for future enlargement of the plant to give double the present capacity, without encroachment on new ground. The whole of the work has been carried out to specifications and designs prepared by the staff of the Gas and Water Department, under the direction of Mr. J. H. Crowther, the Engineer and Manager of the Department.

Further Details.

The retort-settings are contained in the usual type of steel-

sure. The whole of the steam requirements of the plant, including the engines driving the coke extractors, boiler fan engine, and that needed in the retorts, will be supplied by this boiler, with a surplus available for other purposes.

The satisfactory working of a retort-setting is dependent on a sufficient and steady draught. To ensure this an induced-draught fan is fitted at the boiler outlet, the speed of which can be so regulated as to keep the draught on the settings absolutely constant, whatever changes may take place in atmospheric conditions or output of the bench. The fan is driven by a high-speed vertical steam-engine through suitable reduction gear. Between the boiler and the fan is interposed a feed-water heater, and in the inlet flue to the boiler is placed a steam superheater which ensures that the steam used in the retorts is hot and dry —essential qualities for high gas yields.

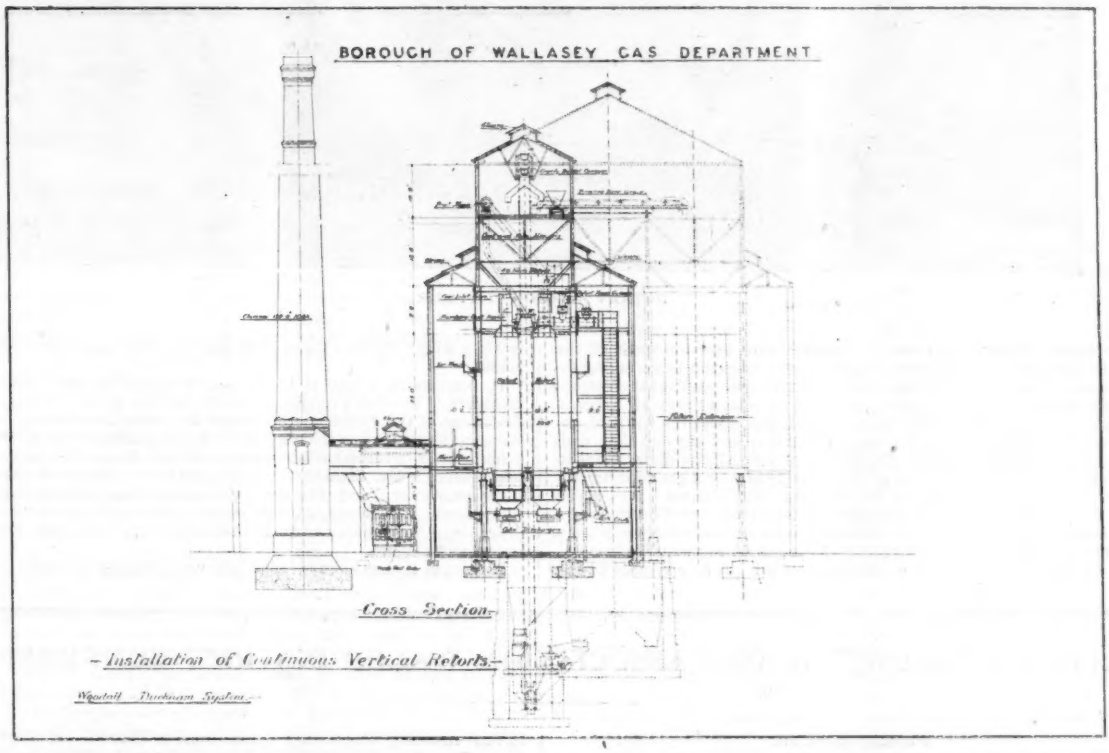
Since the commencement of gas-making operations, this plant has been regularly producing over 2 million c.ft. of gas per day.

The Luncheon.

Subsequent to the inspection, the party returned to the Town Hall, where luncheon was served. The Mayor presided, and Alderman Ashmole was toastmaster. After due observance of the Loyal Toast,

The Mayor proposed "The Gas Undertaking and the Engineer." He was the more pleased, the Mayor said, to have this toast entrusted to him, because he had had the great pleasure of being Chairman of the gas undertaking for six years. In those years he got to know something about gas, whether good or bad; but all he saw about it was exceedingly beautiful to him. It was in 1861 that the gas-works were first opened. Thirty-two years ago the local authority bought the

piece of ground on which the present works stood; and how they were going to extend them in the future was more than he could say. More room was wanted. Their Engineer, Mr. Crowther, had surveyed the land, and under his guidance the gas-works had grown to the magnificent proportions one saw at the present time. [Cheers] The old plant had been scrapped, and now they had an entirely new one. The first extension was made in 1893. Another extension was made in 1903, and a further one in 1910. Then they introduced machine stoking for the horizontal retorts. Afterwards, thinking the newer system was better, they put in the vertical retorts. This was in 1913-14. They found them a success, and after the lapse of a few years the Gas Committee decided to have another new vertical plant. This was the plant the visitors had seen that morning. It was considered to be one of the best plants in the country at the present time, and it would enable the Corporation to supply gas for a few years to come to the people in the Wallasey area and the outlying districts. The works had cost them half-a-million pounds, and he was proud to say they had paid off a quarter of that sum. To show that these works were a paying proposition, he would add that they had contributed £300,000 in relief of the rates. There were 20,000 consumers of gas in the district. They all knew that for lighting [*sic*] electricity had taken the place of gas, but for heating and cooking purposes an enormous amount of gas was used, and everything that could possibly be done to ensure an efficient service of gas was being done by their excellent engineer. [Cheers]. He wished also to say that they had one of the most enterprising, pushing, and persevering Chairmen that any gas undertaking could have in the person of Alderman Evans. [Cheers.] In the course of further remarks, the Mayor spoke of the value, alike to gas engineers, gas committees, and the public, of the conferences of persons connected with the gas industry. With regard to Mr. Crowther, he had known him for many years, and the more he knew him the more he esteemed him. [Cheers.]



Mr. CROWTHER, who was received most cordially, responding to the toast, said his hearers had seen the new works, and would not therefore wish him to go into details concerning them. He had been wondering a little what were the impressions of those men who saw the works for the first time, and realized the extent to which labour-saving devices were now used in a great gas undertaking. It was the earnest wish of the Gas Committee and himself to see gas sold at such a price that people could not possibly afford to be without it in their domestic work. A great deal of labour and dirt could be done away with by the use of gas for heating and cooking. Again, the only rational method of using coal was by carbonization. In visiting the new works they had seen an example of a plant of the most modern type, for the carbonization of coal, calling for very little manual labour. There was now no really hard physical labour in gas-works. By introducing the use of gas instead of raw coal for heating and cooking purposes, they were helping to get a purer atmosphere, and thereby promoting the health and happiness of the community. Touching a personal note, Mr. Crowther said it was very gratifying to learn, from the words of the Mayor, that after thirty years of service with one corporate body he had not outgrown his period of useful service to the undertaking. He did not take to himself all the credit for the good work of the past. He recognized the value of the services rendered by all who had been associated with him, by the technical and clerical staff, and by the workers generally. As to the employees, he did not know any works where they had a steadier and more reliable class of workmen than they had in the Wallasey Gas-Works.

The next toast, "Our Guests," was submitted by Councillor WRIGHT (the Vice-Chairman of the Gas and Water Committee). Wallasey, he said, was noted for its hospitality, and their guests on this occasion were heartily welcome. Touching the question of the use of gas and the furtherance of the gas industry, Mr. Wright emphasized the part played by conferences of gas engineers and others interested in gas-works, and by the Technical Press. With the toast he associated Mr. Arthur F. Bezant (the Editor of the "GAS JOURNAL") and Councillor Luke (the Chairman of the Birkenhead Gas Committee). In the unavoidable absence of Mr. Bezant, he asked Mr. W. A Shovelton (Manchester), who was there on behalf of the "GAS JOURNAL," to respond on Mr. Bezant's behalf.

Mr. SHOVELTON thanked the company for their cordial reception of the toast, and Mr. Wright for his kind words about the Press. He also endorsed the appreciative tributes which had been uttered in reference to Mr. Crowther's services, and expressed the opinion that, bright as had been the history of the Wallasey gas undertaking in the past, radiant as was its position in the present, its future would be still more glorious. With regard to Mr. Bezant, he read the following communication he had received from him relative to the proceedings of that day:

> I have been very interested in reading the brochure describing the extensions at the works. One thing that strikes me is the remarkable development of the gas business at Wallasey. It is not given to every gas undertaking in the country to be able to record that there was, pre-war, a doubling of the output of gas every decade. This is excellent testimony to the progressiveness of both the Gas Committee and their Engineer and Manager, Mr. Crowther, which progressiveness is further illustrated by the character of the plant they adopted ten years ago, and again now. One often hears in these days that municipal management of trading enterprises does not show that acumen and spirit which characterize private management. In the gas industry, with my extensive experience of it, I have not found this to be so; and Wallasey furnishes another example. The fact that nine years ago continuous vertical retorts were in operation there, indicates the early appreciation that there was of the economies and other benefits which that system of carbonizing promotes. Continuous carbonization to-day stands unchallenged and unrivalled for its attributes in the scientific treatment of coal. Had it been my privilege to be a guest on Thursday, I should have expressed the hope that the developments that have been effected in the past, under wise and prudent administration, would continue to be the experience of the Wallasey Corporation gas undertaking and its business.

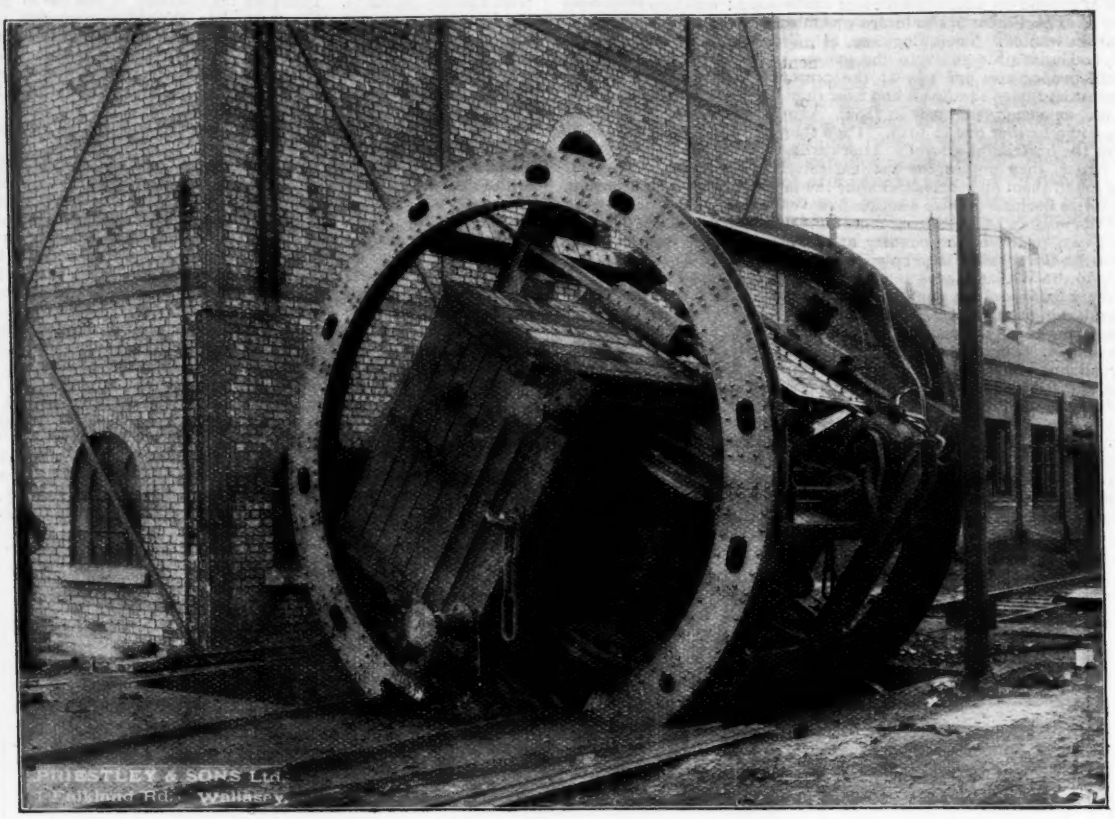
Councillor LUKE, who also responded, pointed to the neighbourly associations of the two boroughs of Birkenhead and Wallasey.

Councillor CHARLESWORTH proposed "Neighbouring Gas Undertakings," coupled with the name of Mr. R. E. Gibson, M.Inst.C.E. (Chief Engineer to the Liverpool Gas Company).

Mr. GIBSON, in his reply, said that, apart from the spirit of friendliness manifested by the presence of representatives of neighbouring gas undertakings, they realized that their interests were identical, and that there was an urgent call for unity of effort and purpose. He wished the Wallasey gas undertaking success. The new works, in his view, had been undertaken on right lines. He desired to congratulate Alderman Evans and his good friend Mr. Crowther, and the contractors, on the very fine installation of vertical retorts that had been put up at the Wallasey Gas-Works. These would, he was sure, be a valuable asset to the borough of Wallasey, and provide for the growing needs of the district. No doubt before long a further extension would be required. At Liverpool the output had been increased by over 33 p.ct. since 1914. They were trying to make the atmosphere purer.

Alderman EVANS then proposed "The Contractors."

Sir WILLIAM JONES, of the Woodall-Duckham Company, Ltd.,



ROTARY WAGON TIPPLER.

responded. He was pleased, he said, to learn how the work of the contractors had been appreciated, and hoped that the undertaking inaugurated that day would prove a beneficial and prudent investment on the Wallasey Corporation's part. There was, as they all knew, a healthy rivalry between electricity and gas, but it was the spirit of co-operation which made for success. Electricity and gas had their own spheres of usefulness, and it was idle for any electricity department to suggest that it was superior to or could dispense with a gas department, or *vice versa*. On concluding his remarks, Sir William Jones asked Alderman Evans and Mrs. Evans to accept from the Contractors a silver salver as a memento of the day's proceedings, which marked a distinct advance in the development of the gas industry in Wallasey.

Alderman EVANS said he would treasure the gift as a symbol of the work in which the Gas Committee and the Contractors had been associated.

In conclusion, a vote of thanks was accorded to the Chairman and members of the Gas Committee, on the motion of Dr. M'MILLAN (the Chairman of the Finance and General Purposes Committee), who took occasion to emphasize the wisdom of trusting officials fully. The Gas Committee had furnished an example of this wisdom by the trust they had placed in Mr. Crowther. It was not fair to blame officials if anything went wrong, and take the credit when things were successful. If treated with confidence, officials would more readily tread the path of progress to the enhancement of their own credit and the satisfaction of their employers.

Alderman EVANS acknowledged the vote, and the proceedings closed.

BRITISH COMMERCIAL GAS ASSOCIATION WALES DISTRICT CONFERENCE.

PUBLIC HEALTH.

The first of a new series of British Commercial Gas Association District Conferences was held in the Assembly Room at the City Hall, Cardiff, last Thursday, when an interesting and helpful afternoon was spent in a discussion on public health from the point of view of the important part played by gas in connection therewith. A keen audience was presided over by Mr. CHARLES E. DOVEY, J.P., F.C.A. (the Chairman of the Cardiff Gas Light Company); and the two papers submitted were by local men, well known in the public life of the city, who are not directly interested in the gas industry. The platform was graced by the presence of the Lord Mayor of Cardiff (Alderman Dr. J. J. E. Biggs, J.P.), the Lady Mayoress, and Mr. Reginald G. Clarry, M.P. for Newport. The "B.C.G.A." exhibit was arranged in the hall.

A WELCOME.

The LORD MAYOR, in extending an official welcome to the conference, said the work that was being done by the British Commercial Gas Association was exceedingly useful. He had been much interested in the wonderful exhibits in the hall, which were extremely instructive. One could not fail to be struck by the great change to be brought about economically, domestically, and scientifically by using gas instead of coal as a direct means of heating. One effect of the valuable bye-products derived from the manufacture of gas should be to bring down the price of drugs and dyes. The one thing personally that he had against the scheme was that he was conservative enough to feel he would be sorry to lose the old coal-fire.

The CHAIRMAN said he desired to express their indebtedness to the Lord Mayor for so kindly coming to the conference, and for extending to them a hearty civic welcome. A busy man like Alderman Biggs must find it extremely difficult to get through all his public engagements; and for him to spare time to come to that meeting was a very great honour indeed. It showed his desire to advance science in every way possible. Of course, a medical man like the Lord Mayor, apart from his civic position, was naturally interested in the important subjects to be discussed—important from the national as well as from the civic point of view. As the Lord Mayor could not wait longer (though he had kindly agreed to preside at Dr. Saleeby's lecture in the evening), he [the Chairman] wished to propose to him now the heartiest thanks of the conference for his presence, and for the welcome which he had extended.

Mr. REGINALD G. CLARRY, M.P., said he regarded it as quite a privilege to have the opportunity of seconding this proposition, and of associating himself with his old colleagues in the gas industry. He agreed that the conference was really of national importance.

THE CHAIRMAN'S SPEECH.

The CHAIRMAN, in his opening remarks to the conference, said that he would like in the first place to point out how keenly indebted they were to the Cardiff Medical Officer of Health (Dr. Ralph M. Picken) for preparing a paper for the conference, and to Mr. E. C. Morgan Willmott, who was to bring before them the architect's point of view. It was particularly gratifying that, at a conference of this nature, they were able to have two such distinguished local representatives to come forward and give them the benefit of their valuable experience on subjects of great importance to all interested in public welfare. As to the aims and objects of the "B.C.G.A.," it had been well said that "no business could attain its highest success unless the idea of service to patrons, customers, and the community was kept steadily in the foreground." So far as the gas industry was concerned, the Association was organized to tackle such important and far-reaching subjects as public health and public housing—particularly in reference to air pollution. The gas industry was

united to improve its service to consumers, and to endeavour to mould public opinion in favour of clean and healthful conditions. The policy of the Association aimed at the conservation and development of the industry as an instrument of public service. It was not animated or directed by hostility to any other industry. Its organizers held that every branch of industry should aim at improving its own efficiency and its own power of serving the community, without seeking to injure other enterprises conducted upon similar lines of just and reasonable policy. To those interested in smoke abatement, it was hardly necessary to point out the many advantages to the community of having coal distilled at the gas-works, and its purified essence delivered ready for use at hearth, range, or boiler, with the smokeless residue (coke) available as an alternative fuel; while the tarry matter, which so materially helped to form smoke when coal was burned in its crude form, was available for many hygienic purposes, such as the prevention of the dust nuisance on roads. If they could purify their atmosphere by burning gas instead of coal on the one hand, and utilizing the tar bye-products of gas-making to prevent its pollution by dust on the other hand, they would have gone a long way in benefiting the health of the community. Just before the war, the meteorological reports revealed that in London the hours of winter fog had been halved, while those of summer sunshine had been doubled, in the previous ten years. This increase in sunshine was, when charted, shown to coincide in a most remarkable manner with the increase in the use of gas-fires during the same period. The side of the subject which Mr. Willmott was emphasizing should appeal not only to architects, but to householders generally. The housing problem was one of the gravest to be faced at the present time; and the question of cost reduction and the elimination of waste was—or ought to be—of interest to all.

THE PAPERS.

The CHAIRMAN then called upon the authors to read their papers.

ATMOSPHERIC POLLUTION AND DISEASE.

By RALPH M. PICKEN, B.Sc., M.B., Medical Officer of Health at Cardiff.

The author prefaced his remarks by stating that in Cardiff they knew very little about the smoke nuisance at present; but it was possible for it to become like other cities, as it became more industrial in character, and as the number of buildings per acre increased. He then went on to point out the effect of smoky atmospheres on health.

Where, asked Dr. Picken, are we to attack this smoke problem? There has been a good deal of controversy in the last two or three years as to the main cause of smoke pollution; and at present the bulk of opinion is inclined to blame the domestic chimney. Personally, he thinks that any attack on the domestic chimney which diverted attention from industrial pollution would be unfortunate. It is true that London, which is rather commercial and residential than industrial, has a very dirty atmosphere. On the other hand, if one surveys Cardiff, and then journeys to Swansea through Landore, it is impossible to escape the conviction that absence of industry means a clear atmosphere and that industry means smoke. It may be, however, that the Welsh domestic coal produces less smoke than that used in the East and North counties. It is a fact, too, that the number of houses to the acre in Cardiff is smaller than in any of the smoke-enshrouded cities; and the spreading-out of the population undoubtedly diminishes the nuisance from domestic smoke. Whatever the relative importance of domestic and industrial sources of smoke pollution may be, it is clear that both sources should be dealt with as far as possible.

Since the beginning of the nineteenth century, numerous committees, official and otherwise, have considered the question of smoke nuisance, and Smoke Abatement Bills have been introduced in Parliament. The latest of the Committees reported in 1921, and the Government introduced a new Smoke Abatement Bill, which had not been considered by the last Parliament before it was dissolved; and so far it had not been introduced again.

While the powers given by the new Bill were an improvement upon those existing, it seemed to the author that a city like Cardiff, which had not yet suffered to any great extent, might well ask for greater protection. It would be no hardship on the new industries to ask them to submit to the authority descriptions of their furnaces, boilers, &c., along with the plans of their buildings, so that the authority might have some assurance that "the best practicable means for preventing the nuisance" (a phrase appearing in the Bill) were being adopted. Dr. Picken believes this would really be a help rather than a hindrance to industry, and would prevent the unpleasant and unsatisfactory proceedings which have to be taken against firms who have already spent large sums on plant which must be altered to prevent further nuisance.

The great problem, however, of reducing the amount of smoke emitted from dwelling-house chimneys is one for the public, for the builders of new houses, and for those whose business it is to supply substitutes for raw coal for domestic heating. The last Smoke Abatement Committee recommended "that the Central Housing Authority should decline to sanction any housing scheme submitted by a local authority or public utility society unless specific provision is made in the plans for the adoption of smokeless methods for supplying the required heat." The Ministry of Health, however, have not so far acted on this suggestion.

The ideal method of heating is one which is mainly radiant, and which reduces convection to the minimum. The coal-fire undoubtedly meets this requirement; but so does the modern gas-fire. Both methods favour free ventilation of rooms, whereas so-called steam radiators (which heat mostly by convection), and to a certain extent electric heaters, are defective in this respect. A reasonable compromise has been suggested—that houses should be built with a coal-fire in one living room and gas-fires in the other rooms. Even with coal-fires, there appears to be some prospect of reducing the smoke nuisance by the economic production of a smokeless fuel. On the other hand, for the purpose of cooking there is little to be said for the old-fashioned kitchen range, except that it combines the function of cooking and heating water for domestic purposes. Gas-cookers are much more efficient and convenient; and in new houses it is possible to instal independent coke-boilers for hot water which are efficient, economical, and smokeless. The old-fashioned kitchen range should be gradually abolished.

PUBLIC HEALTH FROM THE ARCHITECT'S POINT OF VIEW.

By E. C. MORGAN WILLMOTT, A.R.I.B.A.

The author remarked that necessarily the architect's point of view upon smoke must start where the medical experts finish. Not only is considerable damage being caused by smoke and noxious fumes to the greater buildings, but also to the lesser ones—in fact, to permanent structures of all kinds. He is strongly of opinion that, even in Cardiff, which is freer from smoke than most cities, over £100,000 per annum could be saved if there were reduced to a minimum those points at which coal is used in an unrestricted form.

Architecture, he proceeded, is a science as well as an art; and it is important that the usefulness of a building shall not be impaired in any way by the injudicious use of some system of lighting or heating which will have a deleterious effect on public health. Let the authoritative words about the danger of the coal-fire of the domestic hearth be broadcasted to all and sundry. Help the architect to persuade his client of its evils. Help the architect to destroy the old-fashioned fetish of the coal-fire. Help the architect to show his client that he may have a clean, bright, warm, dust-free house, without it, and at a less initial cost.

It was, the author said, his intention to give the conference, in a simple way, his reasons for believing that the use of gas for heating, water supply, and to a lesser degree lighting, is the best of all methods for the simple domestic dwelling. He is building himself a house; and it is an all-gas house, with the exception of one coal-fire. There are gas-stoves, gas-fires, gas-boilers, and a gas-circulator. Why does he use gas-fires? Because

1.—There is a considerable saving in the cost of his house.
2.—It is proved that the quantity of sulphurous and sulphuric acid fumes emitted by gas-fires is much less than by coal-fires.
3.—It is cheaper when one studies the intermittent use.
4.—It is cleaner.
5.—It is an auxiliary solution of the domestic servant problem.
6.—He desires a smokeless house.

You save with gas-fires: (*a*) Space; (*b*) chimney hearths, flues and chimneys; (*c*) forming fire openings, with their arches and flue-throats; (*d*) trimming in roofs and floors; (*e*) chimney pots; (*f*) chimney flashings; (*g*) cost in grates and mantels, and fire appliances; and (*h*) labour in skirtings, cornices, picture rails, &c.

You gain with gas-fires, from the designer's point of view, increased facilities for planning, especially upon narrow frontages. First-floor fireplaces need not be necessarily over ground-floor fireplaces—an important point when one is studying the internal planning and convenience of each individual room. One ma even place a gas-fire under a window; and to the architect thy ability to be able to put his heating almost where he likes is oe inestimable benefit, and can result in an indirect saving in cosf which cannot conveniently be measured. In previous paperst writers have estimated the economy in house construction caused by the adoption of gas heating at approximately 5 p.ct.; but he is sure they have neglected the indirect saving to which he alludes. The author has worked-out the saving in the building of his house, and finds that it is 7 p.ct., or about £185; and at the cost he is sure he will have a better dwelling than his neighbour who still retains the costliness and inefficiency of an open coal-fire.

To sum up, Mr. Willmott is confident that gas heating for the middle-class dwelling-house is infinitely better than any other system that at present exists. To a lesser degree he believes the arguments hold good for the working-class cottage, though for a fire for continuous use in the living-room of a working-class home, the gas-fire would undoubtedly be too costly.

In the City of Cardiff housing scheme at Ely, gas is used for lighting, cooking, and washing, and partially for heating. An important economic fact emerges from the use of gas in this scheme. It was the intention of the City Engineer to light by electricity, and cook, wash, and heat by gas. The Ministry of Health refused—and quite rightly so—to inflate the cost of the houses with the duplicate services; and as gas-cookers, gas-boilers, and gas-fires were necessaries, the lighting followed.

This is important testimony to the all-round use of gas in the dwellings for the working classes.

He went on to congratulate the makers upon the great improvements from an artistic point of view they have effected in the appearance of gas-fires. Gas cooking, from any point of view, is better and cheaper in every way than the coal-range. He does, however, deprecate the idea that such a stove should be treated as a range, and placed in a recess or hole in the wall. It should be kept at least 6 in. away from the wall, in the open, where everything can be seen, and got at, and cleaned. Where cost will allow, steam from the cooking can be got rid of by means of an aluminium canopy. From a planning point of view, the ability of the architect practically to place the gas-stove where he likes is a distinct asset; and under special conditions with a descending flue it may be highly desirable to place it like a table in the centre of the kitchen or scullery.

There is, he thinks, room for some considerable improvement in the design of gas-cookers; and he trusts we have seen the last of the old type, with the oven low on the ground. The space below is a trap for all the filth, dust, and grease, and cannot easily be cleaned. The eye-level cooker seems to be a great improvement, but for the smaller house it takes up too much room. There is still a tendency to flute and ornament the castings of the stoves, especially the oven door and hinges. Plain surfaces for easy cleaning are highly desirable.

For the smaller dwelling, a gas circulator or boiler for the supply of hot water might be considered too expensive for continuous use; but where a coal-fire is provided in one living room, he has found it convenient to connect the two so that either or both can be used. In the larger houses there can be no question that for simplicity, speed, and effectiveness the gas-heated circulator is desirable—always remembering that we are studying these problems from the point of view of the public health, and are looking for the smokeless, dust-proof house. For the same reasons, he advocates the use of gas-heated coppers.

Speaking from twenty years' experience, he is sure that, within its proper limitation, the use of gas for nearly all domestic purposes makes for a general improvement in the health of the community. To the members of the British Commercial Gas Association, there was no need to dispel the bogey of the laymen with regard to several mistaken ideas; but he would like to quote from a lecture delivered by the late Prof. Vivian B. Lewes, at Manchester. He said, speaking of the sterilizing qualities of gas:

"I made some experiments in a room having a capacity of 2700 c.ft., and obtained the totally (to me) unexpected result that when the room was lighted by two Welsbach "C" burners and mantles on a pendant, each consuming 4 c.ft. of gas per hour, the air at the breathing level in the room was far purer and fresher than when three 16 candle incandescent electric lamps were used; and that the result became the more markedly in favour of gas the larger the number of people in the room."

Further experiment showed that the cause of this unexpected phenomenon was that the strong uprush of heated products of combustion from the gas-burners drew-up the emanations from the skin and lungs of the occupants, charred and sterilized any germs that accompanied them, and, reaching the ceiling at a temperature 12° higher than when electric light was employed, diffused through the plaster so rapidly as to draw fresh air into the lower portion and create a brisk draught under the door of the room, and, while so diffusing, filtered-off the charred remains of germs and organic matter on the white-washed ceiling—thus giving the blackened area which always occurs on the ceiling above the gas light in town air, and marks the beneficent work of sterilization that the gas-flame is carrying on, and not, as the advocate of electric light always insists, imperfect combustion.

DISCUSSION.

The CHAIRMAN said they would no doubt first of all like to hear a few words from the Manager of the British Commercial Gas Association.

Mr. W. M. MASON expressed his gratification at being afforded this opportunity of saying how very grateful they were as an Association to the two gentlemen who had come forward and read such excellent papers. The "B.C.G.A." was, of course, primarily a gas industry Association; but these two authors were in no way connected with the gas industry or with the "B.C.G.A." They were both public men, and were at that conference, not in the interests of gas, but in the interests of public service. The papers were the more effective because they came from the independent professional side. Health and housing were vital problems; and in dealing with both, gas was able to be of the greatest possible assistance. The "B.C.G.A." was not "anti-" anything. It was "pro" gas—progressive. Gas was the fuel of the future.

Mr. GEORGE CLARRY remarked that he thought this was the first occasion on which the "B.C.G.A." had inaugurated and carried out a real health conference; and the audience would wish to congratulate Mr. Mason and his Committee on having done so. The problem of smoke abatement seemed to live for ever. It had been recognized for perhaps hundreds of years; and still it was with them. It was impossible to say how much longer its solution would be delayed; but Parliament had had the matter in hand, and perhaps they might hope that some of their young and energetic legislators would take it up again. As they all knew, during the war a great number of the men called up for medical examination were returned as only "C3;" and he had often wondered how it was that such a state of things could exist in their so-called healthy and happy England. But it seemed that they as a nation were full of apathy. They had an inertia which prevented them from removing the abuses around them. In better and brighter surroundings, there was no doubt that the physical condition of the men to whom he had referred would have been much improved. There was still a great way to travel before they could arrive at such an important result as the complete abolition of smoky products from the chimneys. It appeared from all that had been said that it was the domestic chimney which was the chief culprit in this sense. He remembered on one occasion when he was coming from the North of England through Lancashire on a beautiful bright morning, it became shady, then dull, and finally black. Then gradually it became lighter, and they passed into the sunshine once more. The explanation was that they had passed through a Lancashire manufacturing town. Another experience was when on one occasion he had climbed Ben Nevis. From the top there was a beautiful view, and then suddenly a bank of cloud appeared beneath them, and very soon the party were enveloped in a thick fog, which, however, was not white, but full of smuts and smell. Their guide informed them that it came from the works on the Clyde. Thus not only did the smoke nuisance interfere with the towns where it was produced, but sometimes it travelled onwards. As had already been stated, Cardiff itself was free from the smoke nuisance. The city was really as good as any health resort in the United Kingdom; and this was largely due to the great care that was taken in laying-out the district. The Directors of the Cardiff Gas Company were very much alive to the hygienic influence of fresh air, and had done everything they could to encourage the use of gaseous and smokeless fuel. Many industries were supplied with gas for heating. Among these he might mention ordinary baking and baking on a very large scale, laundry work, welding-on of tyres, annealing, case-hardening, and sugar boiling. In fact, numerous processes that might have been carried on by coal fuel were being performed by gas. Another very important branch of the work the Company had attempted to do was in connection with domestic cooking and heating. There were 39,000 cookers regularly at work in Cardiff; so he thought they would admit that the Company had "done their little bit." There were also in the city 28,000 gas-fires, which took the place of coal-fires. The question arose as to what further they should do—for he could assure them that the Company had by no means got to the end of their resources. They were only on the fringe of a great and wide subject, which they hoped to tackle successfully by progressive and scientific measures, and with the hearty co-operation of the medical men and architects of the city.

Mr. LEO JOSEPH, J.P., proposing a hearty vote of thanks to the authors of the papers, said Dr. Picken had rightly drawn their attention to the fact that Cardiff was very free from smoke. For the purity of the atmosphere, as for the purity of the water supply, they were largely indebted to the foresight of their councillors, both past and present. Though it was a large industrial city, it was not a manufacturing one. As to what class of consumers were mostly to blame for the smoke nuisance, he thought the main reason why domestic fires received the larger proportion of the blame was because with them the process of combustion was not nearly so complete as was the case with the large industrial users. Speaking personally, he still liked to see the cheeriness of the coal-fire. The one great attraction of gas for domestic warming was that it was really a better distributor of heat throughout the room than any other method that he knew of, from the radiating point of view. This was an extremely important factor. The use of gas also possessed great advantages in the matter of cleanliness; and the addresses they had heard that afternoon from experts would be of great benefit to them all. The organizers of the conference had done good public work by bringing so vital a subject forward. In expressing their indebtedness to Dr. Picken and Mr. Willmott he was sure he was voicing the sentiments of the entire audience.

Mr. J. HERBERT CANNING, in seconding the vote, said he would like to lay particular stress on the educational value of such conferences, because it was in this direction that they must look for progress in this matter. Until they educated public bodies to the supreme importance of the question under discussion, and got them to consider it carefully, they would not be able to do much with the public themselves. Those who had had the privilege of listening to Sir Henry Gauvain at Bristol last October would remember the extraordinary instances he brought before them of children crippled—one might say saturated—with tuberculosis, and he afterwards displayed other pictures showing the immense improvement that took place in the condition of these children simply from exposure to sunshine, and permitting them to live in the fresh and open air as far as possible. One could hardly express adequately the enormous extent of the improvement that resulted from this simple treatment. If this was the case, it stood to reason that they must endeavour to strike at the root of these diseases, and to remove from their cities this pall of smoke which at present was preventing people from enjoying a sufficient amount of sunlight. Anything that could be done in this way must be of great benefit to humanity. In Cardiff, he would imagine that there could not be less than 50,000 inhabited houses; and even during the fuel restrictions in the war, each house was allowed 3 tons of coal per annum, which made 150,000 tons. This was much below the actual figure; but assuming 3 tons per house, with a sulphur content, at 1½ p.ct., of 33 lbs. per ton, and taking one-half of this as volatile, they arrived at an amount of over 3000 tons of sulphuric acid passing into the atmosphere of Cardiff every year. Thus even if Cardiff did not suffer from smoke, there was something given off by the coal which, though not visible to the naked eye, affected the inhabitants. Therefore the matter was of importance. Mr. Willmott had put in a good word for gas lighting, and in this he was right. A great many objections were raised against gas lighting in certain quarters; but, as the late Prof. Lewes had pointed out, there were many things to be urged in its favour. There was one matter in particular which was put forward against gas lighting—namely, the allegation that it caused more rapid blackening of the ceilings than occurred where it was not installed. He hoped he would not be considered as voicing undue criticism as to a building in which he was a guest; but he had been looking at the ceiling of the room in which the conference was being held, in which no gas was used, and there seemed very little difference between it and ceilings of apartments in which gas was employed exclusively. Cardiff was to be congratulated upon possessing so broad-minded, enlightened, and progressive a Medical Officer.

Dr. BURPITT remarked that he had gas-fires in his house, but it

seemed to him the air in a room where there was a gas-fire got very dry. It was more than a question of mere discomfort. Something ought to be done in connection with gas-stoves to allow of that vapour which was being taken away from the air being restored. He saw no reason why a gas-fire should not be made as effective in appearance as a coal-fire.

The CHAIRMAN said he was sure the British Commercial Gas Association would be able to satisfy the last speaker with regard to the matter he had raised. Great things had been expected from the conference, and they would not go away disappointed. As to the much discussed therm, it was, in the opinion of men qualified to judge, the greatest safeguard that had been vouchsafed to the British public in connection with gas supply. He recalled that some time ago the Cardiff Gas Company's Directors visited Birmingham, where the Corporation had then only recently started supplying gas for industrial processes. In a few years, however, Birmingham had reached a consumption for industrial purposes which equalled the total consumption of Cardiff. The Gas Company would welcome industries in Cardiff, believing that they could supply them efficiently with gaseous fuel. Mr. Clarry had told them that his Directors were a progressive body. Well, the Directors had a progressive Executive in Mr. Clarry and his colleagues.

On the proposition of Mr. MASON, a hearty vote of thanks was passed to the Chairman for presiding, and to the Board of the Cardiff Gas Company and Mr. Clarry for their hospitality and cordial co-operation in connection with the meeting.

Afternoon tea was then served.

A LOCAL EXHIBITION.

The conference coincided with the holding in the city of a Food and Health Exhibition, in which a fine display is being made by the Cardiff Gas Company; and at the close of the meeting a number of those who had been present proceeded to the exhibition—which, it may be remarked, is remaining open during this week.

The Gas Company have an excellent exhibit, which is arranged in three sections. There is a kitchen with a combination of cooker, circulator, and gas-fire, in the space usually occupied by the coal-range. There is also on view a wash-boiler. During the day demonstrations are given of cooking and laundry work. The circulator supplies hot water to a bath in the second section, where a geyser and small water-heaters are also shown in operation. There is here a prepayment gas-fire meter, connected-up as would be the case in boarding-houses or hotels. For the lighting of the bathroom there are "Economy" burners; and a demonstration is made of the heat-resisting qualities of "Vitreosil" globes, by means of a spray of water impinging upon a globe surrounding a lighted burner. The lounge (which is the third section) is fitted with a handsome gas-fire and surround of the most modern style. The lighting is by superheated burners with handsome silk shades, all the burners being controlled by pneumatic switches. In front of the stand is a demonstration of shop lighting with six-light "Littleton" lamps. Visitors are exhorted to "Banish domestic drudgery by installing a gas kitchen in your home," and are informed that, "For pure radiant heat a gas-fire is sunshine in the fireplace."

The hall is lighted throughout by sixteen 1000 C.P. high-pressure Keith lamps.

LIGHT AND LIFE.

In the evening an interested audience gathered again in the Assembly Room at the City Hall to hear Dr. C. W. SALEEBY, F.R.S. Edin., lecture on "Light and Life."

The lecturer has for a great number of years closely allied himself with the subject of smoke abatement, and was able to give his hearers a large number of startling facts and figures regarding the effect of smoke on the national health.

His first protest was against the pollution of their bodies by burning coal the wrong way. Coal, he said, was really a chemical treasure house; and they should distil from it all its wonderful bye-products, munitions of peace and war, and chemicals of a thousand kinds. At the end of this process, they found themselves with certain materials only fit to burn, and these they should burn and use as the national source of fuel. One was coke, and the other gas. They should not live on their capital of coal, and waste it shamefully, as at present. Water power, electricity, and coal used as it ought to be, did not obscure the cities in a barrage of smoke, and cut out the sunlight—the best medicine, the best stimulant, and the best antiseptic ever known, or that would be known. It was being discovered that the impact of the sun on the skin was one of the most valuable foods—he was speaking literally, and not in metaphor—that anyone could absorb. It directly affected the blood in a way that could not be done by any other means. Light was the first cause of life; and the terrible thing in England was that they were cutting themselves off from the light in their cities. He could never praise sunlight enough, and no one knew how much it was worth. The whole gamut of respiratory diseases, and the disease of rickets, he called the diseases of darkness.

The lecture was illustrated by a series of lantern slides.

Information with regard to successful applications of gas to sundry industrial processes is to be found in No. 107 of "A Thousand-and-One Uses for Gas," published by the British Commercial Gas Association, No. 30, Grosvenor Gardens, S.W. This issue has been specially prepared to meet the needs of busy men. It contains brief statements of fact, illustrated by numerous excellent photographs. Gas undertakings should benefit by bringing it to the notice of industrial fuel users in their districts.

MIDLAND JUNIOR GAS ASSOCIATION.

A Meeting of the Association was held at the Council House, Birmingham, last Thursday—Mr. C. F. W. RENDLE (Redditch) presiding.

A recommendation of the Council was approved in favour of reducing the amount of the subscription for the current session from 12s. 6d. to 10s., including a copy of the Joint Transactions.

The following paper was read by Mr. James W. Wood, M.Sc., A.I.C., of the Fuel Department of the University of Leeds. Mr. Wood, who had been engaged at the Birmingham Gas-Works for the past four or five years, has lately returned to his headquarters at Leeds.

RECORDING GAS CALORIMETERS AND THEIR USE.

The gas industry is a progressive industry, and on the manufacturing side is keenly anxious to utilize its raw materials to the utmost advantage. The devising and successful development of new carbonizing processes demand close supervision, while all processes, both new and old, may show profitable returns for increased exactitude in technical control, and closer limits of working. Attention will here be confined to the examination of the calorific value of gas.

THE VALUE OF RECORDING CALORIMETERS.

In many manufacturing processes the final product is capable of being stored prior to sale to the public. While in store it may be subjected to test, and if not up to the standard set by the firm, by specifications or by trade requirements, may be returned to the factory for further treatment. With gas this is not possible, and our largest holders represent but a very small storage capacity as measured by the time their contents would last if for any reason the manufacturing plant were to be shut down. Moreover, adjustment of gas quality in the holders is only practicable to a very limited extent; and the obvious course is to see that the gas going into the holders is of as uniform a quality as the operation of the plant will permit.

A test of the quality of the gas being made is therefore necessary; and to be of any service in allowing adjustments of the plant to be made it is essential that the result should be accurate, and above all available in the shortest possible space of time.

It is not necessary to dwell upon the unsatisfactory character of isolated or "spot" tests for control purposes, and it is now the established practice in many works to have tests of calorific value made at intervals of not more than two hours, and in some cases much more frequently. To those who practise and appreciate this course, a reliable continuous record of calorific value will appeal most strongly, as the equivalent of still more numerous tests without the necessity for a corresponding increase in apparatus and staff.

Apart from control of manufacture, recording gas calorimeters have received a greatly enhanced importance since the passing of the Gas Regulation Act, 1920, which places the sale of gas upon a thermal basis, and specifies the use of a recording calorimeter in this connection. So important has the matter become, that available forms of recorders have been subjected to most careful examination by the Fuel Research Board, the Referees, and the Institution of Gas Engineers, in order to determine their reliability under various conditions of use.

Inventors have not been idle, and our thanks are due to those public-spirited engineers who have in the past given facilities and encouragement in installing and experimenting with the earlier types of recording calorimeters, under works conditions. One of the stumbling blocks to the inventor of calorimeters is lack of knowledge of the conditions under which his instrument will be called upon to work in practice; and the difference between works and laboratory conditions is one of the commonest causes of failure. It would seem that we have still to look forward to the arrival of the perfect recording gas calorimeter, the readings of which will suffice for all legal requirements; but in the meantime we have several recorders, which, despite their vagaries, are capable of rendering most useful service, provided they are used with intelligence and given reasonable attention.

THE OBJECT OF THE PAPER.

The present paper does not pretend to afford detailed descriptions of recording calorimeters, but rather to call attention to points which arise in their selection and use. If it succeeds in indicating the general lines upon which the examination of a recorder might be conducted so as to form some opinion of its potential accuracy, and its suitability for use in specified circumstances, then its object will have been attained. It is also hoped that the paper will call attention to certain points which, if not entirely new, are in danger of being overlooked in the development of the interesting mechanical details of recording calorimeters. Although the paper has been entitled "Recording Gas Calorimeters," attention will first be directed to non-recording instruments.

There is ample justification for this step, inasmuch as attempts were naturally made, at first, to perform the necessary operations mechanically, and convert existing water-flow calorimeters into recorders. It so happens that where expectations have not always been fully realized, the difficulty has been as much with disturbing causes common to recording and non-recording calorimeters alike, as with the mechanical adaptation. Moreover, recorders are

usually checked with a water-flow calorimeter, which may either form an integral part of the recorder or be an independent unit; and for obvious reasons it is necessary that it should be used in such a way as to yield an accurate result for the purpose of giving a correct setting to the pen of the recorder.

Lest there should be any misunderstanding, it may be pointed out that it is not essential for a recorder to be a water-flow instrument, and totally different principles of construction and operation may be utilized in a recorder so long as it is capable of accurate standardization, and will retain its calibration.

Types of Recorders.

If we place in two groups those calorimeters which have reached a practicable stage of development, it will be seen that the water-flow instrument by no means predominates.

Water-Flow Recorders.	Other Principles.
Simmance "Total Heat" Recorder	Thomas Recorder
"Fairweather" Continuous "	Beasley "
Boys Recording Calorimeter	Sigma "
	The "Calorgraph" and the "B.Th.U." Recorders of Messrs. Alex. Wright & Co., Ltd.

The theory underlying the main operations of a calorific value determination with a water-flow calorimeter is extremely simple. A measured volume of gas is to be burned under suitable conditions; the heat so generated is to be imparted to a measured quantity of water; the temperature rise in the water is to be measured. The calorific value is then to be calculated in accordance with the following formula:

$$\text{Calorific value} = \frac{3{\cdot}968\ T\ W}{n\ G}\ \text{B.Th.U. gross per c.ft. at 60° Fahr. and 30 in. barometer.}$$

where,

G = volume of gas burned during test, in c.ft.
W = volume of water collected in same interval of time, in c.cs.
T = temperature rise in calorimeter in ° C.
n = tabular number—*i.e.*, the factor for reducing the observed gas volume to its equivalent volume at 60° Fahr. and 30 in. barometer.

3·968 is a factor necessary because some of the quantities are measured in metric and others in British units.

The Accuracy of a Calorific Value Determination.

The accuracy attainable in such a determination is worthy of study. There should be little difficulty with a properly water-lined, $\frac{1}{10}$ c.ft. test-meter, using a whole number of revolutions of the drum for the test, in determining the volume of gas burned to ± 0·25 p.ct. The tabular number can be determined to ± 0·1 p.ct. if the barometer reading is correct within 0·03 in., and the meter temperature within 0·25° Fahr.

As usually constructed, the meter thermometer responds more quickly to a change in the temperature of its surroundings than does the bulk of the water in the meter case; and therefore accurate readings of the meter thermometer are valueless unless the meter has been at its indicated temperature for some time.

There is no difficulty in reading the quantity of water delivered during the test, using (say) the type of cylinder supplied with the Boys calorimeter, within ± 5 c.c., equivalent to about ± 0·25 p.ct. on the quantity of water delivered.

The measurement of the temperature rise is usually the least satisfactory item of a calorific value determination, and it is difficult to give a precise idea of the possible error involved. Provided it is compatible with the proper working of the instrument in other respects, a temperature rise of 10° C. is very convenient, allowing reasonable accuracy of reading the temperature rise without introducing excessive radiation or other losses from the calorimeter. Thus with a properly used thermometer graduated to $\frac{1}{10}$°, estimation to $\frac{1}{5}$ of a scale division would represent an error not exceeding ± 0·2 p.ct., or 1 B.Th.U. for a 500 B.Th.U. gas. The proportionate error in thermometer reading with the Boys calorimeter, where the temperature rise is approximately 20°, would, of course, be half this amount. It cannot be pointed out too strongly, however, that the accuracy of reading a thermometer scale is not the same thing as the accuracy of the temperature measurement it is alleged to represent. It would seem to be commercially impossible to produce mercury-in-glass thermometers of the usual type (long stem 0°—50° C.) which are accurate even within 0·1° C., representing say 5 B.Th.U. on a calorific value determination; and it is by no means uncommon to find errors of 0·25° and even 0·35° C. As we are only concerned with the measurement of temperature differences, it might be thought sufficient to determine the zero errors of the thermometers in melting ice and apply suitable corrections; or, as was recommended in a recent publication, to immerse both thermometers in the same bath and apply the observed difference as a correction to one or other of them. Neither of these processes is of any value for calorimetric determinations, because it is very seldom that the error is distributed evenly over the whole stem of the thermometers.

Each laboratory should have at least one calorimetric thermometer which has been carefully standardized by the National Physical Laboratory—certainly at points 5° apart, and preferably at 2° intervals. This can then form a working sub-standard with which all other thermometers can be compared, again at 2° intervals; and equipment of this kind is not to be regarded as an extravagance in a well-appointed laboratory. This careful standardization of thermometers is necessary to avoid discrepancies in testing where an undertaking possesses more than one plant the working of which it is desired to compare, or where there are several calorimetric outfits. It is vital in such operations as making inter-comparisons of calorimeters, or detecting the slight changes which may take place in gas quality consequent upon transmission for long distances, or compression for high-pressure distribution purposes.

Returning to the original discussion, it will be readily understood that even under favourable conditions of use we have no justification for ascribing a greater accuracy than ± 0·5 p.ct. or (say) ± 2 B.Th.U. to any individual determination we may make. The fact that duplicate determinations on the same gas frequently do agree within 1 B.Th.U. or even less, does not invalidate this view. To return calorific values to the first decimal place, is ascribing a fictitious accuracy to our work, even if we regard the last figure merely as a "guard" figure; while the use of two and and even three decimal places is utterly ludicrous. In passing, it is to be noted that if a calorific value is to be determined in such a way that it can be reliable to 1 B.Th.U., very special care must be taken with respect to all conditions under which the test is carried out; and this implies much more than extra careful making of the usual routine observations. Provided there are no systematic errors of the apparatus, the quarterly average deduced from determinations made in a careful routine manner should not be in error by more than 1 B.Th.U.

Inspection of the Apparatus.

The making of many calorific value determinations is very monotonous, and is frequently carried out by junior assistants. There is little doubt that an intelligent youth, reasonably alert and conscientious, can very soon attain the necessary dexterity, and can make the few observations indicated above with such exactitude that there will be little fault to find with the result. This is the justification usually put forward by those who advocate the practice. It should, however, be the province of a senior assistant to inspect the apparatus frequently, and be satisfied that it is working under conditions which will yield accurate results. The principal points to which attention must be paid are the gas-tightness of all connections; the correct water-lining of the meter; the correct gas rate and water rate; the relation of inlet water temperature to room temperature; the steadiness of inlet and outlet water temperatures at the calorimeter itself, so that the figure returned for the temperature rise is a fair average for the test; the systematic rather than haphazard taking of temperatures during the test; where it is adjustable, the regulation of the draught through the calorimeter; at certain times of the year, the absence of draughts due to open doors and windows; and last but not least, the proper entering of all relevant figures and details of the test, with checking of the calculations by which the final result is attained. Many of these points are common to recording and non-recording calorimeters alike; and if they are not properly attended to, no amount of care and skill in making the actual observations will yield results of the desired degree of accuracy. Yet it is these operating conditions which are most often neglected and possibly imperfectly understood.

I have not taken into account those larger accidental errors which occasionally arise due to misreading of the main divisions of the meter, thermometers, barometer, or water cylinder, as no generalization can be made.

Taking into account the requirements of commercial work, it may be said that with any one calorimetric installation, duplicate tests on the same gas should agree within 1 p.ct., although on account of systematic errors, different instruments used with equal care may show variations up to 2 p.ct. If this increased discrepancy is due to instrumental differences, the remedy is clearly in official inspection and certification of at least one complete set of apparatus at each station, with which subsidiary installations can be compared. If it is due to variation in operating conditions at different stations, then the conditions of use must be more fully specified and they must be strictly observed. It is an experience which may prove most enlightening to those whose facilities will allow it, to set up two or more complete sets of apparatus quite independently, and then determine the calorific value of gas from the same source on the several instruments. If there is a difference, it is then an opening for some interesting detective work; for provided there is nothing radically wrong with any instrument, the results should fall certainly within 1 p.ct. of one another. In all cases care must be taken that the calorimeter has been burning sufficiently long before a test is made, and three-quarters of an hour with the Boys and half-an-hour with the Junker calorimeter would appear to be the minimum safe time to allow before a test is made. With the three recording calorimeters mentioned above as water-flow instruments, the calorimeter by means of which the recorder is checked is continuously burning, so that this waiting period is eliminated, and a check test is possible at any moment—a feature which is often of the greatest importance when the reading of the recorder is in dispute.

While dealing with the accuracy of apparatus, it may not be out of place to note the evidence given by Prof. Boys in the recent therm inquiry with respect to apparatus submitted to the Referees for examination. The rejected apparatus is presumably such as could not be rendered really serviceable by the use of a certificate of corrections; and it will be noted that with the exception of the meter-proving measures, the rejections average about 10 p.ct.

	Examined.	Rejected.
Long thermometers graduated $\frac{1}{10}°$ . . .	1334	132
Short thermometers graduated single degree	1547	211
Water-measuring vessels	501	37
Meter-proving measures	371	6

As given by the "JOURNAL," Dec. 20, 1922.

Enough has been said, I think, to show the inadvisability of continually correcting the pen of a recorder for small errors which after all may be due to unavoidable errors in the check tests. Personally, I should not think of altering the pen of a recorder upon the basis of a single check test, unless the difference were greater than 10 B.Th.U.; and a duplicate test would be made to confirm the setting. For small errors a tablet beside the instrument, upon which the correction can be noted, is very useful, although with certain types of workmen, the admission that an instrument is liable to any error whatsoever, exerts a peculiar psychological effect. Let us imagine that we have the prospectus of a recorder before us, or that we are listening to a description given by a demonstrator. What points are we to pay attention to in forming an opinion with respect to the recorder as a whole? The relative importance of certain points will naturally vary with the construction of the recorder and the principles adopted in its design and operation; but there is sufficient in common to all recorders to allow of laying down a rough general scheme of examination. Decision will also be much influenced by the use to which it is intended to put the instrument.

THE CRITICAL EXAMINATION OF A RECORDER.

It is too much to expect any very great simplicity from an instrument which has to perform very complicated functions; and yet there may be simplicity of a kind, if the instrument is properly understood. The recorder will in all probability consist of four or more separate units. If each of these is simple in itself, and has some definite function to perform, and of which the accuracy of working can be checked without disturbing any other part of the recorder, then I should class that recorder as "simpler" than one with perhaps fewer parts, but in which there was combination of functions. To correct a recorder by movement of the pen on the chart is a very simple thing. It is like moving the hands of a clock or watch when it fails to indicate the correct time, and admittedly is often the correct thing to do. It is, however, quite hopeless to correct for serious internal derangements in this way. Hence my preference for a recorder which is an assemblage of simple parts, the working of which can be readily checked in turn, and a systematic method be adopted for locating the source of any error which appears as a deviation of the pen from its correct position on the chart. I have been induced to dwell a little on this point because undoubtedly some of the recorders on the market do at first sight appear to be so complicated as to place them at once out of bounds as works' instruments. It is to be hoped that they are not really so. As was pointed out at an earlier stage, the requirements of the gas industry are becoming more exacting, and we shall expect from a recorder very much the same degree of accuracy as can be obtained from the check tests—*i.e.*, we shall expect a recorder to give a chart correct within ± 0·5 p.ct., or (say) ± 2 B.Th.U. Most recorders consist of three, four, or an even greater number of parts, each subject to its own peculiarities of behaviour. It will be exceptional for the instrument to be so designed that the errors of certain parts will, under all conditions of use, exactly neutralize those of others. Thus it comes about that the permissible error or irregularity in any one part of the recorder cannot be much greater than ± 0·1 p.ct., if the maximum accumulated error of the whole instrument is not to exceed ± 0·5 p.ct.

We are therefore expecting regulation and control of a very high order; and far from grumbling at shortcomings, we should congratulate the makers of several recorders upon the measure of success which they have attained. Nevertheless, in scrutinizing any part of a recorder, or any operation, we must always have in our minds the question—to what extent does this factor influence the calorific value finally shown on the chart?

When explaining the action of a recorder, the makers frequently state (and even assume in the design of the calorimeter) that discharges of water through orifices under different heads, and of gases of different qualities under the same or different pressures, follow well-known "laws," these being given in the form usually found in books on mathematics, physics, and engineering. As a rule the "laws" are followed with greater or less accuracy, and the formulæ are undoubtedly of immense importance in engineering practice, for they enable calculations to be readily made of a sufficiently accurate nature for many purposes, while their simplicity gives them a value which would not be possessed by more exact but more complicated formulæ, where such are known. It is doubtful if any of the various assumed "laws" are followed with the accuracy demanded in a recording calorimeter; and while the general principles of operation may be correct, an instrument may fail when we attempt to work it within the ± 0·5 p.ct. limit which has been so frequently mentioned. Theory is of little service here; and the precise deviation of a particular instrument under specified conditions of use can only be determined by direct experiment. The order in which various points are taken up will depend largely upon the design of the recorder, and perhaps I may be criticized for relegating some very important matters to the miscellaneous section 9, which is given below. The accurate working of a recorder is the thing which must have our first attention.

THE CHIEF FEATURES UPON WHICH KNOWLEDGE IS REQUIRED.

The main points upon which information is required with respect to a recording calorimeter are as follows:

1. A rough general outline of the SEQUENCE OF OPERATIONS which the recorder is expected to follow.
2. THE GAS CONTROL.—How it is effected, and under what errors it is liable to suffer, the influence of changes in gas quality and pressure, and in atmospheric temperature and pressure. Also the means of verifying the meter, where such is fitted.
3. THE WATER CONTROL.—How it is effected and how it is likely to be affected by the character of the water supply both as regards purity and temperature fluctuations. Where the heat absorbent is other than water, this section will be suitably modified. Any provision of a special water supply for the recorder—*e.g.*, a system for continuously circulating and cooling the same water.
4. THE TEMPERATURE RISE.—Its magnitude, how it is measured, and how it is influenced by fluctuations in the temperature of the water supply.
5. THE RECORDING MECHANISM.—What principles are employed in transferring the indications of the calorimeter to the chart; for correcting the position of the pen on the chart; and for ensuring that it has the correct range of movement on the chart. In addition, details as to the type of chart and chart drive.
6. TABULAR CONTROL—*i.e.*, correction for changes in the temperature and pressure of the gas so as to yield a record which shows the calorific value of the gas at 60° Fahr. and 30 in. barometer. Nearly all recorders attempt this correction, and in some instruments this section might be merged in (2) or (3).
7. PROVISION FOR CHECKING THE READINGS OF THE CHART, and whether this can be done conveniently without causing a break in the record.
8. THERMAL GAINS OR LOSSES.—This is a very important but somewhat difficult section. It will be readily admitted that the only heat for which the calorimeter can legitimately claim credit is that produced by the combustion of the gas in the calorimeter. Care must therefore be taken that the calorimeter is operated under such conditions that no heat other than that produced by the combustion of the gas reaches the calorimeter, and on the other hand that no heat is lost. The principal sources of error are, of course, radiation gains or losses to the body of the calorimeter, heat brought into the calorimeter by the incoming air and gas, and heat carried out by the products of combustion leaving at too high a temperature. The extent of the errors can only be determined by experiment, and the methods to be adopted call for ingenuity to yield the desired information, and involve physical measurements of considerable delicacy. It is to be feared that the extent of such irregularities is not always fully realized; and calorimeters are operated under any but favourable conditions. A little thought will make it clear that an error of this kind in the non-recording portion of the instrument will in many cases not be detectable by the usual routine tests, because both chart and check test are affected equally by the disturbing causes. In such circumstances agreement between observed and chart calorific value is no proof of the correctness of the chart. In other cases the design of the instrument is such that observed test and chart calorific values are not similarly affected, and in this case we may have erratic and puzzling discrepancies between the observed and recorded calorific values. Only detailed examination of the instrument concerned can enable a correct judgment to be formed.

OTHER FEATURES WORTHY OF REGARD.

9. MISCELLANEOUS POINTS.—This section is capable of almost endless extension and subdivision; and doubtless the "practical" man would give some of the points priority over those already dealt with. Only a selection of points can be suggested.

   (*a*) Amount and nature of attention required. This is always a controversial point; and naturally the makers of the recorders may be expected to give a conservative estimate. Much will depend upon the conditions under which the instrument is called upon to work. Dirty apparatus, especially when it is likely to come to the immediate notice of the engineer or interested high officials of an undertaking, creates distrust, and is not to be tolerated. On the other hand, too frequent cleaning is likely to lead to the derangement of delicate mechanism and do more harm than a little discoloration of metal work or loose dust. On no account should the instrument be handed over to a somewhat heavy-handed cleaner, even "under the supervision of the chemist." The gas-works chemist of the future will have to add the care and cleaning of recording calorimeters to his already crowded curriculum; and the work must be

done thoroughly. In the larger works it will pay to have the recorders in the hands of one man, who by training and natural aptitude and temperament has been found specially fitted for the work. In my experience, I find that in the greater number of cases it is not the actual fault which is the trouble, or its correction, but the correct and rapid diagnosis of a defect based upon a knowledge of the working of the recorder. At all events the temptation to make some adjustment, in the hope that it will improve matters, must be avoided, and a careful record of all alterations made should be rigorously kept. Often the attention required is of a simple kind—such as the water-lining of a meter, the cleaning of a jet, or the adjustment of a chart or other simple matter; but on the whole this attention is needed more frequently than is admitted, if satisfactory working is to be secured.

(*b*) Durability of the recorder is important, but requires no other comment.

(*c*) Availability of spares and replacements.

(*d*) Initial cost is in my opinion of very minor importance compared with reliability in use; but there is naturally a limit in this direction. Figures soon become obsolete in these days, but the water-flow recorders at the present time range between £100 and £200 complete.

(*e*) The amount of space required, and the nature of auxiliary apparatus that may be required, but which is not provided as part of the recorder.

(*f*) General accessibility of parts and convenience of manipulation of the apparatus.

(*g*) The provision of "safety appliances" to prevent damage to the recorder or to the building in which it is placed, in the event of failure of either gas or water supplies.

(*h*) Means for water-lining and checking the capacity of the meter.

The Lag of a Recording Calorimeter.

There are a number of other points of general interest in connection with recording gas calorimeters, which may be mentioned. One question always asked is that relating to the "lag" of a recorder, since it naturally takes some time to respond to changes in gas quality. The lag may be divided into two portions, one of which ought really not to be put down to the discredit of the recorder at all. It is obvious that for the chart to have any useful meaning, the gas supplied to the recorder should come from a "live" main. This involves connection with a length of service the diameter of which varies from ¾ in. to 1 in., according to the taste of the designer. It should not be too small. Different recorders consume from 0·5 c.ft. per hour with the Boys recorder to 2 c.ft. per hour with the Beasley and Simmance recorders and 5 c.ft. per hour with the Fairweather calorimeter. It is left as an exercise in simple arithmetic to determine how long the gas in 100 ft. of 1 in. service would last each of these recorders. This portion of the lag may be reduced by shortening the service as much as possible, or by fitting a burner or other gas-consuming appliance to the service just beyond the calorimeter, in order to maintain an efficient draught on the service. Where practicable, connection to the works exhausters is convenient. The other portion of the lag is due to the gas capacity of the meter and its connections, and to the thermal capacity of the calorimeter, itself being greater when the ratio of the thermal capacity of the calorimeter to the rate of heat generation is high. As far as our present knowledge goes, response is quickest with the Sigma recorder, of which the thermal capacity is extremely low; but most recorders on the market will reach a steady indication for ordinary changes in gas quality if the change is sustained for 10 minutes, while the greater portion of the change will be shown in 5 minutes.

The question of lag is important in checking recorders, although, if at all possible, it is preferable to wait until gas of a uniform quality is available before attempting to carry out check tests. A sample holder, of sufficient capacity to keep the calorimeter burning for two hours or more, is a great convenience in checking, as strict uniformity of the gas supply is then assured for reasonable repetitions of the test. It has been recommended that recording calorimeters should be placed in a basement, where temperature changes are likely to take place very slowly. This is not always possible, and often other situations will of necessity be used. It is, however, unreasonable to expect accurate results from a recorder which is exposed to severe draughts, to the rays of the sun at certain times of the day, or to the irregular intensity of radiations from fires or steam pipes.

In the earlier part of the paper it was indicated that the two main uses of recorders were in control of manufacture and in examination of the finished gas on the district. In each case there are advantages and disadvantages so far as the working of the recorder is concerned. On the works the recorder will frequently have to deal with gas of a very variable quality, although with continuous vertical retorts the trouble may be minimized; it will sometimes be in none too favourable a position as regards cleanliness and thermal steadiness of its surroundings, and the water supply may not be satisfactory for continuous operation.

Against this, it will be subject to frequent inspection; and if observed to require adjustment, sufficiently skilled operators will usually be available to make the adjustment before the error has assumed proportions of any consequence.

On the district, conditions are somewhat different. The recorder will generally be in more favourable surroundings, and supplied with gas of more constant quality; conditions which in themselves are conducive to accurate working. It is unlikely, however, (at least so far as official recorders under the Gas Regulation Act are concerned) that they will receive frequent attention; and a defect, which if immediately noticed and attended to would be of little consequence, may develop into a serious error before the official responsible for the care of the instrument can give it the necessary attention. Some little organization will be necessary also if the readings of recorders on the district are to be of any service to the engineer on the works, although their main function when so placed is undoubtedly inspection of the gas supply, and the protection of the consumer. Possibly greater accuracy might be demanded of a recorder on the district than on the works; but this is a point which I should be very loth to press. Undoubtedly the time factor is one of the most serious to be faced in designing recorders. It is necessary that they should operate for long periods preferably without attention. Those of us who have had to deal with non-recording instruments where serial measurements have had to be made in close succession, know that despite constant head devices and governors the various flows have rarely been strictly constant even over periods of a few hours at a time; the observed variations being greater than we should care to ascribe to experimental, or rather observational, errors.

Caution to be Observed in the Interpretation of Averages.

One word of warning may be necessary as to the interpretation of the average calorific value obtained from a recorder chart. The methods of construction and operation of every recorder with which I am acquainted cause gas to be consumed at a constant rate (or nearly so). This means that any average taken from a chart, assuming it to be a reliable indication in all other respects, will be a time average. From a large installation with a nearly constant output, the average so obtained will not differ greatly from the true average quality of the gas made. On the other hand, if we attach a recording calorimeter to a plant for the purposes of an investigation—*e.g.*, the determination of the thermal efficiency of gas production—some care must be used in applying the chart readings; otherwise strange results may be obtained. Thus in the case of a horizontal coal-gas plant, the output of gas from the charge at different stages in the carbonizing period is subject to considerable fluctuations. The total therms in the gas will be obtained approximately by taking the output for each half-hour and multiplying the result by the average chart calorific value for that time, and then adding together all the products for the duration of the carbonizing period. A very different and erroneous result may be obtained by averaging the chart calorific value over the whole carbonizing period, and multiplying this figure by the total volume of gas made. The case is even worse with a single blue or carburetted water-gas generator; and it is doubtful in this case if a recorder could respond sufficiently rapidly to the changes in gas quality during the comparatively short gas-making period to obtain an average thermal output, even if simultaneous observation of the volume output were made. To a lesser extent the same difficulty occurs with the variable output from the works to the district; and it must be admitted that while the recorder does not strictly enable one to determine the "heat units supplied to the consumer," the time-average as given by the chart, with a clause respecting the fall below a certain value for more than a specified period, can be of great service in the control of gas quality, and has the advantage of being fairly practicable.

In conclusion, I should like to acknowledge the permission granted by Prof. Cobb to present this paper to you, and, if it is not presumptuous, speaking for the time being as an ordinary member of the Junior Gas Association, to express appreciation of the action of the Institution of Gas Engineers in attempting to make the sale of gas upon a thermal basis a practicable scheme, and in expending both time and money in the investigation of recording gas calorimeters, which are likely to be important adjuncts to its successful execution.

At this stage in the proceedings, Mr. Wood furnished very brief descriptions of some of the leading types of recorders, assisted by lantern slides and specimens of charts, thermometers, and other apparatus.

DISCUSSION.

The President said the paper was one of great importance, for the gas engineer was thinking of calorimetry more than ever before. They were looking forward to the time, he said, when recording calorimeters would be used for the purpose of completing the chain in the legalizing of the sale of gas on a therm basis. It was of the utmost importance that the calorimeters should be closely observed and properly cared for. Mr. Wood did not state exactly what was the percentage of error, when the points which should be looked after in conducting a test were not observed. The "lag" might be due to the fact that the gas being dealt with in the calorimeter was not always the gas that was being made at the same moment. It would appear wise to ascertain what the time-lag was. He did not see why, if long services could be taken and the lag minimized by making further use of the exhausters, all the calorimeters could not be located in one room. Why should a calorimeter be placed in the retort-house?

Mr. Wood observed that by accelerating the flow of gas through a long service, one might depreciate the quality.

Mr. W. J. Pickering (Nechells, Birmingham), in moving a vote of

thanks to Mr. Wood for his excellent contribution, agreed that the effect was not satisfactory if gas were drawn quickly through long services. He had observed depreciation in quality of more than 20 B.Th.U. by reason of the scrubbing action exerted by the service. In regard to the errors present in calorimeter thermometers, it had been the practice at Birmingham for many years to check all such thermometers, against a standard certificated instrument, every 2° between about 4° and 40° C., which represented their normal working limits. One of the first things a works chemist learned was that he could not take all calibrated apparatus at its face value; and the calorimeter thermometer was no exception to this rule. The more one knew about apparatus for the determination of calorific value, the more one realized how many points there were to be watched. In the early days of the installation of recorders in the Birmingham works the Beasley was the type chosen, and the effect of draughts and variation in the room temperature was very soon appreciated and guarded against. Provided the special precautions which Mr. Wood had mentioned were duly observed in installing and supervising these recorders, their record was of great assistance to the engineer.

Mr. L. H. THOMAS (Nechells) seconded the resolution, and observed that while the paper was technical, it was exceptionally lucid, and they had been able to appreciate the main points as to the methods of using calorimeters, and those which might produce errors. The point made that recorders were often not correct by reason of room temperature fluctuation, should be carefully noted. Such variations occasioned considerable trouble; there should be as far as possible a constant temperature, and in works processes the time records were most useful.

Mr. E. H. WRIGHT (Wolverhampton) agreed as to the large fluctuations that occurred if these sensitive instruments were in such a position as to subject them to draughts.

The CHAIRMAN spoke of the value of a recording calorimeter chart in attempting to calculate the thermal output. The recording instruments should be properly cared for. It was apparent that deposits in flues might have a bearing on the records. In the case of the Sigma instrument it occurred to him that the temperature factor had a great influence.

Mr. G. CLEMENTS (Walsall) inquired if it were possible for the calorific value of gas under high pressure, all other conditions being equal, to vary in different parts of the same district. In one part of his district there had been back-firing of burners, which would appear to indicate a drop in calorific value.

The vote of thanks to Mr. Wood was carried with acclamation.

Mr. WOOD, in reply, said he had recently returned to Leeds after a most interesting experience at the Birmingham works. It was always a pleasure to discuss technical matters with men of mutual interests. He pointed out that American practice specified that no gas should in ordinary circumstances be tested within three-quarters of a mile from the works. In London, as far as official tests were concerned, there was no appreciable drop in outlying testing stations 9 or 10 miles away. As to the stripping of gas in the services where a one-inch pipe was used, it might be expected with rich carburetted water gas or 550 coal gas; but these drops also took place with gas as low as 480 B.Th.U. There was on the district and on full-scale work no detectable drop in value, so that any differences to be noted from street to street must, he thought, be attributed to some other cause.

A Laboratory Multiple Burner.

In a communication to the "Journal of Industrial and Engineering Chemistry," Mr. Frank C. Vilbrandt remarks that the control of the rate of heating of a large number of laboratory burners under a single vessel is difficult owing to the numerous regulating points. This difficulty was overcome in the laboratory of the University of North Carolina, at Chapel Hill (N.C.), by the construction of a burner with a single regulating part. The burner is made from standard pipe and fittings, is inexpensive, lends itself to quick change in height and number of jets, is easy to regulate, and is efficient in gas consumption. Comparative runs with the same number of Méker burners indicated a saving in gas, more rapid heating, and a considerably easier control. Either a cone flame or a Méker effect can be produced by capping the jets with wire gauze. The burner is made from ¾ in. ells, tees, close nipples, reducers, and a cross. The jets are pieces of piping set in tees. The regulating valve is a tee in the service line, into one arm of which is attached the set of burners, and into the other a glass jet extending well into the burner-line. Into the top arm is placed a capped nipple, the open end grooved with V-shaped cuts, which provide for the regulation of the air introduced by screwing this up or down in the tee.

Wood-Refuse Power Plant.—A firm of timber merchants, in a big way of business, recently decided to replace the old power plant at their extensive Gainsborough works with a modern one; and they have now had installed apparatus designed by Messrs. Horace Boot and Partners, which uses as its sole fuel the sawdust and wood waste obtained from the works. There are two Babcock and Wilcox boilers, with specially enlarged furnaces for burning wood fuel, and mechanical stokers of the Gordon Allison type for feeding in wood chips. It is stated by "Engineering" that the sawdust and chips are collected from the various machines by means of a pneumatic removal plant of the Sturtevant Engineering Company, Ltd.; the material collected being discharged into cyclone hoppers situated on the boiler-house roof in front of the boilers. These hoppers discharge their contents partly into the stoker hoppers, and partly on to the boiler-house floor. Small blocks of timber, logs, and odd pieces are collected on trucks and wheeled along a track to the boiler-house. The contents of the trucks are deposited on the floor near the boiler-fronts, and fed into the boilers by hand, together with the shavings that cannot be manipulated by the mechanical stokers.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

The Third Meeting of this session of the Western District of the Scottish Junior Gas Association was held in the Royal Technical College, Glasgow, on Saturday, Jan. 13. Mr. W. J. LENNOX (Falkirk) was in the chair, and the attendance of members was encouragingly large.

THE MANUFACTURE OF WATER GAS.

Mr. JAMES HALL (Glasgow) read a lengthy and highly informative paper on "The Manufacture of Water Gas." He explained exhaustively the features of the plant at the Temple Works, Glasgow, and elaborated upon many tests and experiments he had carried out there.

PLANT AT THE TEMPLE WORKS.

The generating plant consists of three complete Humphreys and Glasgow carburetted water-gas sets, of a total capacity of 3 million c.ft. per diem, when using about 2½ gallons of oil per 1000 c.ft. For the blowing plant there are two (one space) No. 8 Sturtevant blowers, driven by 30 B.H.P. De Laval steam turbines. The turbine rotor runs normally at about 18,000 R.P.M., driving the fan through a ten-to one reduction gear. The gas after passing through the condensing plant is pumped through two parallel 8-in. mains to Dawsholm, where it is mixed with the coal gas in the foul mains.

The normal cycle in operation at present is 1½ mins. blow and 3½ mins. run, divided into 1 min. up, 2 mins. down, and ½ min. up steam. This cycle is taken as a basis for working, but has to be varied from time to time to suit the particular variety of coke supplied. The successful working of a water-gas plant depends so largely on the fixing of a cycle which is most suitable for the fuel available, that it cannot be too strongly advocated that, where at all possible, a section of the coal-gas plant should be isolated for use with a certain type of coal, and the coke so obtained supplied to the water-gas plant. Uniformity could thus be obtained both in that section of the coal-gas plant and also in the subsequent treatment of the coke in the water-gas plant.

Clinkering is normally carried out every four hours, and may occupy anything from 15 to 50 minutes, depending on the type of fuel and the state of the generator. Immediately after clinkering the generator is charged with coke to a depth of about 7 ft., and the fuel bed subjected to a 2 mins. blow, followed by a 3 mins. uprun. The normal cycle is then carried out (say) seven times, when the generator is again charged with fuel. This 40 mins. cycle of operations is carried on throughout, except for the four runs just before the next clinkering, when the cycle consists of 1½ mins. blow and 3½ mins. upruns, to cool the lower part of the fuel bed.

CLINKERING.

Clinkering may well be termed the *bête noire* of water-gas manufacture. Without this troublesome and arduous operation, the process might be termed ideal from a labour point of view. In a large undertaking where anything from five to fifteen different types of coal are carbonized daily, one can realize what a truly wonderful and weird variety of coke mixtures can be obtained from these coals.

During the past two years at Temple, said Mr. Hall, I have had to deal with quite an interesting variety of coke. Our normal fuel is that typically Scotch variety, real dour stuff, forming clinker which has a particularly bad habit of growing up the sides of the generator walls, and most difficult to dislodge once it has formed there. Dealing with this fuel when of fair size is bad enough; but when it consists largely of small dirty coke—say, from poor non-coking doubles or trebles—it presents quite a difficult proposition. We have on occasions to alter our cycle by introducing a 2 mins. blow and 3 mins. run every third cycle, or even alternate cycles, and at the same time work with considerably less steam per minute. It is a question whether it pays so to alter the cycle, with resultant increase in pounds of coke per 1000 c.ft., in an endeavour to raise sufficient heat to run down the clinker, or work the generator for a shorter period, and switch-over to a fresh set, when the growth of clinker on the generator walls becomes too pronounced. As a rule, we adopt the latter alternative, and cut the clinker out by hand.

For a short period we had to deal with coke from a fair quality Durham coking coal. This coke was much more amenable with our normal cycle. In this case we were able to keep the clinker from growing up the walls, while at the same time increasing the steam up to about 30 lbs. per minute with a fresh generator. Not only so, but, by judiciously cutting down the steam from time to time, we could keep the set working efficiently so long as this type of coke was supplied.

In bringing to your notice another type of coke, I have a feeling I may be opening up old sores. I refer to the coke obtained from American coal. From the point of view of water-gas manufacture, this eventually proved an excellent variety. It took a short time to adapt ourselves to this particular coke; our first experience being to burn-out a set of false bars within a week. With our normal cycle, the clinker simply ran down the walls; and on opening the cleaning doors, there it was—in a semi-molten state, on the fire-bars. In fact, it had to be pinched out from between the bars. To counteract this, the percentage of up runs was

first increased; but eventually we cut down the blow period to 1 min., and kept the run of 3½ mins. duration—introducing a complete up run every third cycle, with six up runs before clinkering. With this cycle we could keep our generator open for an indefinite period, limited only by any mechanical defects cropping up, or by the collection of dust sufficient to throw a back-pressure on the plant. One noticeable feature of this coke was the high sulphur content, which occasioned inconvenience during clinkering operations.

From tests carried out on the fusing-point of the ash in coke obtained from various Scotch coals, it was found that the fusing temperatures varied from 2000° to 2800° Fahr. Very little difficulty was experienced with the lower fusing-point ashes—say, up to 2300° Fahr. The clinker which formed was successfully brought down on to the fire bars, and could be removed during clinkering operations. But with the higher fusing-point ash, the clinker persistently grew up on the generator walls, and defied all attempts to bring it down.

When dealing with the high fusing-point ash, I have formed the opinion that it is not worth while attempting any drastic alteration in the cycle. Increasing the percentage of down runs does not affect the growth of clinker, which tends not only to grow up, but to build-out from the generator walls, until the free space becomes so restricted that the set has to be put off and the clinker cut out by hand.

Control of Inerts.

The different percentages of the inert constituents in blue water gas serve as a very useful guide for the correct manipulation of the plant. At Temple we endeavour to keep the CO_2 content round about 3 p.ct. by volume. This may be lower than necessary when the volume of gas is the chief consideration. The N_2 content in the gas is largely controlled by the method adopted in operating the plant. In good practice the total inerts should run about 9 p.ct. by volume, so that by intelligent manipulation of the plant the N_2 content may be kept in the region of 5 p.ct.; and as after all it is the sum of the inerts which is the chief consideration, the CO_2 content need not, except when occasion demands, be kept so low as 3 p.ct., but with advantage the figure may run to 4·5 p.ct., thus allowing an increase in the make of gas per ton.

Anent the consideration of CO_2 content, it is found that this gradually increases as the run proceeds, due to the temperature of the fuel bed falling, while the volume of steam passing remains constant throughout the run. Suggestions have been put forward from time to time to introduce a device which would automatically reduce the steam flow as the run proceeds, and thus allow the maximum amount of steam to be introduced at the commencement of the run, when the temperature of the fuel bed is highest, and so reduce the steam flow that the amount passing at the end of the run would just be such as would be economically decomposed. Such a device, I believe, is in use in some installations, and it would be interesting to have the experience of anyone using the arrangement.

The foregoing remarks apply, of course, to plants not fitted with waste-heat boilers. Where these are installed, the reduction in the boiler pressure during the run periods automatically reduces the amount of steam passing to the generator as the temperature of the fuel bed falls.

Troublesome Deposits.

A fruitful source of trouble in the operation of the plant is due to the deposition of quite a large amount of a very finely divided powder, which is carried forward with the gas. This powder practically defies complete deposition by ordinary methods. It is found in varying quantities in all parts of the plant. A certain amount is brought down in the washers and carried forward into the seal pots, whence it can easily be removed; but the real trouble arises after this point.

Originally the water gas from Temple was pumped through an 8-in. main to Dawsholm; and I understand that after the plant had been in operation for about two years considerable trouble was experienced due to excessive back-pressure on the exhauster. A second main was then laid, and the two mains arranged to be worked either singly or in parallel. When the new main was opened and the old main closed, a very decided drop in back-pressure was noticed, which pointed to the fact that there must have been some serious obstruction in the old main. Steps were taken to locate the trouble. The main was tapped at several places; and at a spot where it takes a fairly sharp bend, it was found to be so badly choked that two lengths had to be removed and the pipe thoroughly cleaned. The deposit in the main consisted of brownish dust in a fairly dry state at this point, but coated with tarry matter, which seems, together with its fine state of division, to render its removal at any desired place a most difficult operation.

As a guide to the future condition of the mains, I made a series of tests, by gradually increasing the volume of gas passing, and reading off the corresponding back-pressures thrown, other conditions being constant. I plotted a graph which represents the conditions when the mains are clean, so that by taking a similar set of readings at any time and comparing the curves I can determine approximately the state of the mains. Increase of treatment of the mains with water does not appear to have much effect.

The following is an analysis of a sample of this deposit taken from the water-gas main.

		P.Ct.
Moisture		51·6
Tarry matter		22·9
Residue 25·5 p.ct.	Ash	17·1
	Combustible matter	4·6
	Volatile matter	3·8
		100·0

The ash consists largely of SiO_2, but also contains small amounts of Fe_2O_3 and Al_2O_3.

Thermal Efficiency.

Those of you who have read the Sixth Report of the Gas Investigation Committee on the Manufacture of Water Gas will appreciate the value of such an investigation, and the help it gives to anyone running a plant. Working on the lines indicated in this report, I have endeavoured, with the means at my disposal, to ascertain as nearly as possible the actual thermal efficiency of the production of blue water gas, as ordinarily carried out at the Temple Works.

These results were obtained at a time when we were experiencing considerable trouble due to poor quality of coke; and, of course, it must also be borne in mind that the plant was producing blue gas only. The cycle of operations and general routine was that already described as our "normal" cycle; but at the time the number of clinkerings per diem had been reduced from six to five per set. The coke was carefully sampled, and the gross amount charged ascertained from the number of bogies containing a known weight. Average samples of the blue water gas (unpurified) were also taken over periods of two to three hours, and used for complete analysis, and for the determination of calorific value.

The test extended over a period of 24 hours, with two sets working. Some of the principal results are shown in Tables I., II., and III.

Table I.—*Results per ton of coke (dry basis).*

Time working No. 2 set	24 hours
Time occupied in clinkering and coking	6·16 ,,
Actual time gas making	17 84 ,,
Coke (wet) supplied to generators	38·5 tons
Moisture in coke	13·1 p.ct.
Coke (dry) supplied to generators	33 45 tons
Total gas (unpurified) made (cor. N.T.P.)	1,691,000 c.ft.
Gas made per ton of coke (dry basis)	50,600 ,,
Coke per 1000 c.ft.	44·35 lbs.
	P.Ct. by Volume.
Composition of gas—H_2	= 46·8
CH_4	= 1·4
CO	= 41·4
O_2	= 0·1
CO_2 and H_2S	= 3·1
N_2	= 7·2
Total inerts	= 10·4
Gross calorific value	296 B.Th.U. per c.ft.
Therms per ton coke	149·7
Steam to generator in tons per ton coke	0·607
Steam to turbine ,, ,, ,,	0·418
Fuel in therms per ton of coke to raise steam for generator (70 p.ct. boiler efficiency)	21·66
Fuel in therms per ton of coke to raise steam for turbine (70 p.ct. boiler efficiency)	14·93
Total fuel in therms per ton of coke for raising steam.	36·59
	P.Ct. by Volume.
Composition of blow gas—CO_2	= 9·0
O_2	= *Nil*
CO	= 16·6
N_2	= 74·4

Table II.—*Results per ton of coke (dry, ash free).*

Coke to generators in tons.	25·56
Gas per ton of coke, c.ft.	66,200
Coke to generators, lbs. per 1000 c.ft.	33 85
Therms per ton of coke	195·8

Table III.

Steam pressure in main = 100 lbs. per square inch.

Steam to generator in lbs. per min. =		
No. 1 set	24½	26½
No. 2 set	25	28
Steam pressure at turbine nozzles.		
In lbs. per sq. in. during blow period		90
,, ,, ,, run period		60
Pressure in inches of water at blower outlet.		
During blow period		17
During run period		19½

The following analysis of the coke used will give some idea of the type of fuel we had to deal with at the time this particular test was carried out.

Approximate Analysis of Coke.

	Dry. P.Ct.	Wet. P.Ct.
Moisture	—	13·1
Volatile matter	4·6	4·0
Ash	28·3	24·6
Fixed carbon	67·1	58·3
	100·0	100·0

Calorific value (gross) in B.Th.U. per lb., 11,600.

In the following figures showing water, carbon, and heat balances, the various items have been ascertained as accurately as possible in ordinary practice, and at least show actual working results.

Water Balance.

The water balance indicates the amount of steam used in the various operations connected with the manufacture of water gas. The results are calculated in lbs. of steam per 1000 c.ft. of water gas.

1.—Water equivalent of water gas	23·60
2.—Water vapour accompanying water gas	3·29
3.—Total steam supplied to generators	26·89
4.—Steam used by turbine	18·5
5.—Total steam used	45·39
6.—Steam to generator decomposed	87·8 p.ct.

Item (1) was calculated from the composition of the water gas given in Table I., and item (3) from details obtained from the gas makers' sheets. I was unable to make a direct determination of item (2), so that it is arrived at in this instance merely by subtraction. Item (4) was calculated from observed steam pressure on turbine nozzle and data supplied by the makers. Item (6) represents the ratio:

$$\frac{\text{Item 1}}{\text{Item 3}} \times 100$$

Carbon Balance.

The carbon balance is of interest in that it shows the actual distribution of the carbon contained originally in the coke. The results are first calculated in lbs. of carbon per 1000 c.ft. of water gas, and then represented as percentages of the amount originally present in the coke supplied to the generators.

Carbon in Lbs. per 1000 C.Ft.		Percentage Distribution.	
1.—Coke	33·44	1.—Coke	100·00
2.—Water gas	15·4	2.—Water gas	46·05
3.—{Ashes, Clinker, Dust}	3·0	3.—{Ashes, Clinker, Dust}	8·98
4.—Blow gas (diff.)	15·04	4.—Blow gas (diff.)	44·97
	33·44		100·00

Item (1) is obtained from the analysis and amount of coke supplied to the generators; and item (2) from the composition of the water gas given in Table I. I have grouped together the carbon content of the ashes, clinker, and dust, and arrived at an approximate figure, as I was unable to obtain detailed figures. Item (4) is determined by difference—*i.e.*, item 1 *minus* item 2 and item 3. It is interesting to note the percentage of carbon in the coke which is actually found in the water gas.

Heat Balance and Thermal Efficiency of Gas Production.

A complete heat balance is not here shown, owing to the difficulty in ordinary practice of obtaining the necessary details to make up the expenditure side of the heat account; but sufficient information is available to arrive at the thermal efficiency.

The results are first calculated in therms per 1000 c.ft. of water gas made; the heat to raise steam being the amount from 60° Fahr. with 70 p.ct. boiler-efficiency $= 1116 \times \frac{100}{70}$ B.Th.U. per lb.

If the total heat supplied is taken as 100, and the other items worked-out in proportion, then these figures will represent percentages of the total heat supplied, and the thermal efficiency of the process will be indicated by item (4).

Heat Balance.

Therms per 1000 C.Ft. of Water Gas.		Percentage.
Heat supplied:		
1.—Heat in fuel to generator	5·145	87·65
2.—Heat in fuel to raise steam to generator	0·429	7·32
3.—Heat in fuel to raise steam to turbine	0·295	5·03
	5·869	100·00
Heat accounted for:		
4.—Potential heat of water gas	2·960	50·04
5.—Balance	2·909	49·96
	5·869	100·00

∴ Thermal efficiency of gas production
(*a*) taking into account fuel for steam to generator and turbine = 50·04 p.ct.
(*b*) omitting ditto = 57·5 p.ct.

CARBURETTED WATER GAS.

Dealing with the working of the plant when using oil, the author said that the amount of oil required to give any desired calorific value depended upon the particular variety of the oil used and the cracking efficiency of the plant. The following serves as a useful guide: 1 gallon of oil per 1000 c.ft. of carburetted water gas will increase the calorific value of the blue water gas by 100 B.Th.U.

In our particular case, the amount of oil required was very easily ascertained, as with the cycle in use the make per run per set was approximately 3000 c.ft., so that for 450 B.Th.U. gas the oil needed was approximately 4·5 gallons per run per set. In the run of 3½ mins. duration the oil was sprayed in during the first 2½ mins.

I append typical analyses of carburetted water gas made with varying amounts of oil.

At Temple the cost of production of blue water gas is, owing to prevailing circumstances, rather high. The following is an analysis of the actual cost in pence per therm, taking the blue water gas to have an average calorific value of 300 B.Th.U. per c.ft.

Oil per 1000 c.ft. in gallons	¼	½	1	1½
	Per Cent. by Volume.			
H_2	44·0	42·0	38·7	38·4
CO	41·0	40·7	38·1	36·4
CH_4	3·2	5·2	7·9	9·5
CO_2	3·4	3·4	3·8	3·7
C_mH_n	0·8	1·3	3·0	4·6
O_2	0·2	0·2	0·2	0·3
N_2	7·4	7·2	8·3	7·1
Gross B.Th.U. per c.ft.	325	350	400	450

Costs.—Pence per Therm.

Gas making (includes total labour)	0·95
Coke at 24s. per ton	1·97
Breeze to boiler, 8s. per ton	0·29
Stores and maintenance	0·09
Total	3·30

With oil at 5½d. per gallon, the total manufacturing costs of carburetted water gas, of a calorific value of 450 B.Th.U. per c.ft., would thus amount to:

3	therms B.W.G.	9·9
1½	,, from oil	7·875
4½	therms C.W.G.	17·775d.

= 3·95d. per therm.

The paper concluded with a few remarks on the subject of steam generation for the plant; and figures were given for the trial of one of the Babcock and Wilcox water-tube boilers in use at Temple. An efficiency of boiler and grate was given of 67·4 p.ct.; and several working points of interest were touched upon.

DISCUSSION.

Mr. M'GRATH (Temple), in opening the discussion, said that he had worked with the author during the period when the tests were made. For this reason,, he could appreciate the value of the paper they had just heard, and the results given.

Mr. ROBERT GRAY (Hamilton), in thanking the author for his contribution, said that water-gas manufacture held very great possibilities—the greatest, perhaps, being that of low cost of production. It had been proved by experience that the most productive and most efficient method was by gasification of the coal in separate plants. This could be done first in the reduction of coal to coke, and then in the further reduction of coke to ash in a water-gas plant. Preferably they should have horizontal retorts for coal-gas plant. In a test run on the plant at Kirkintilloch—horizontals and Humphreys and Glasgow water-gas plant—which extended over a period of 28 days, the make per ton of coal was 22,090 c.ft., and the calorific value 475 B.Th.U., equal to 104·97 therms. The water-gas plant produced 58,746 c.ft. per ton of coke. Further, the efficiency of gas production in the water-gas plant, not taking boiler fuel into account, was 68·170.

Mr. FRAZER (Dalmarnock) said that Mr. Hall had given them more than a paper. To his mind, it ought to be classified as a valuable treatise. He believed the time would come when even the vertical retort would pass into the background, and that the future method of the industry would be some form of chamber oven. With regard to steam generation, he had made a test upon boilers identical with those at Temple referred to by Mr. Hall, and he had obtained a boiler efficiency of 74 p.ct. A comparison of the results obtained from boilers at Dalmarnock and Temple showed a greater efficiency, to the extent of about 5 p.ct. at the former place.

The PRESIDENT, in congratulating the author, said the paper was admittedly one that could not have been prepared without considerable labour, and the expenditure of much valuable time. Their thanks were due to him.

Mr. HALL, replying to the discussion, which was somewhat brief, said that the quality of coke used in generation during the testing period was far from all that could be desired. Once again he was bound to emphasize the importance of supplying the generator with the best fuel possible. No doubt, the results obtained at Kirkintilloch were largely due to the good quality of coke used in the generator. In the boiler test, he had experienced difficulty in obtaining complete combustion of volatile matter in the fuel.

Mr. W. N. Westlake on the Therm.

"The therm has not increased or decreased the amount of any gas bill by one iota," declared Mr. W. N. Westlake, the Manager and Secretary of the Exeter Gas Company, in an address to the City Rotary Club on the much discussed subject of "Therms." He drew attention to the necessity for a change in the system of charging for gas consumption. Gas was no longer used for giving light itself, but for heating-up a fabric to incandescence, and it was the fabric that gave the light, and not the gas. To the consumer it was now the heat value that mattered, and not the illuminating value. In Exeter the declared value was 475 B.Th.U. per cubic foot.

If the charges had been continued in cubic feet, the gas bills would have been the same. In one particular road in Exeter over 50 p.ct. of the accounts were lower, and just over 49 p.ct. were higher than previously. The explanation was that the gas bill was controlled by the consumer, and not by the gas company. It was entirely wrong to say that there was a general big increase of gas accounts last Midsummer in Exeter.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Problem of the Small Works.

Sir,—I have read your last week's leader on the problem of small works, and also Mr. Gill's article, with much interest.

The question raised is a most important one for the industry. Within a radius of 18 miles from Manchester there are no less than 40 separate gas undertakings. The total make of gas is about 17,000 million c.ft., and eight of the undertakings supply approximately 80 p.ct. of this quantity, leaving the remaining 20 p.ct. spread over 32 separate authorities. Half the number of undertakings make less than 100 million c.ft.

In practically the same area there are only 21 electricity generating authorities, and they are co-ordinated more closely than ever before through the South-East Lancashire Joint Electricity Advisory Board.

A comparison of the two sets of conditions is worthy of note.

William Kay

(Chairman of the Manchester Corporation Gas Committee, and Chairman of the Manchester District Executive Board of the National Gas Council).

Manchester, Jan. 20, 1923.

Selling Gas By Volume of Declared Quality.

Sir,—I have not, as you state, objected to "selling by quality instead of by volume," but on the contrary—otherwise I should not trouble you further.

What would probably happen if the therm system of *charging* were withdrawn "cuts no ice," because we should continue to *manufacture* on the therm basis; and I ask you, Sir, what better service can be assured to the consumer in selling "by the therm" than can be accomplished in selling "by volume of declared heat content;" and of all the advantages accruing from manufacture by the therm, which of them could not be passed on to the consumer by the alternative method? From cubic foot to therm seems too long a single stride in all circumstances—two steps would have been preferable.

Edwin Upton.

Liverpool, Jan. 22, 1923.

The Therm Inquiry.

Sir,—When Mr. Milne Watson, in evidence, stated that one result of the method of charging introduced by the Act was that "gas consumers throughout the country are enabled to compare *on a true basis* the cost of gas supplied by various undertakings," he hit the nail on the head.

The therm has come to stay; and the trouble now is not that gas costs more with this new method of charging, but that there is *no true basis* on which to compare the new and the old.

When charged by the therm the consumer knows exactly what he is charged for; but when charged by the 1000 c.ft., he has no idea what he is charged for, other than that it is a certain volume which may contain anything from 3 to 5½ therms in the 1000 c.ft. At 5s. per 1000 c.ft., this may cost anything from 1s. 8d down to 11d. per therm, but still be charged for as 1000 c.ft.—*i.e.*, volume not value.

Undertakings which have come under the Act are bound to supply gas of a certain declared calorific value, and failing to do so are liable to severe penalties. Compare this with municipal and private company undertakings which are practically a law unto themselves, and can supply gas of any quality they like without being questioned by anyone. It is of course said that municipalities are not allowed to make profits; but as the converse they are not in any way prevented from, and have no great inducement to avoid, making losses which would be the ruin of statutory companies. They can and do spend on official and other expenses sums which would never be permitted by a dividend-earning undertaking. A municipal gas committee can never have the same "practical" interest as a board of directors in keeping down costs.

What is wanted now is to bring every undertaking under the Act; and then they would require to declare what they were supplying, and an all-round true basis of comparison would be got. The provisions especially relating to gas testing ought, in the interests of consumers, to be at once put in force compulsorily, and with no option as to the appointment of examiners, and the publication of their reports.

Why should a municipality adopting section 1 of the Act be required to appoint a gas examiner *only* on the requisition of a certain number of consumers? If necessary in the case of statutory companies, it is surely quite as necessary, if not more so, in the case of municipalities.

Jan. 20, 1923. Consumer.

The Broken Gas-Main.

Sir,—People seem to be so used to gas leakage that they do not think there is any danger in it. I spent a summer in London. On entering my bedroom, I said: "There is an escape of gas somewhere." I was told: "It is nothing. It is only the gas-bracket, which has been like that for some time." I immediately wrote to the Gas Company, and next morning they came and fitted a new gas-bracket.

People must be made to realize the dangers, by leaflets giving the necessary instructions. It is no use saying that there is no gas laid-on in the house, if at your door the main is defective. Policemen, &c., ought to have instructions to look for gas escapes as we attend to fires. Would it not pay gas companies to indemnify people who come and tell them where there is a smell of gas?

C. Dasnières.

La Barronette, Chemin de la Pevote, Toulon/mer, Jan. 13, 1923.

Locating Leakages Under Roadways.

Sir,—About eight years ago I brought out a little instrument for locating leaks in mains, and found that there was a ready demand for it. In fact, we sent a number to gas-works all over the world. During the war, the manufacture was dropped; but it has been restarted. The instrument avoids breaking-up expensive roads, and enables leaks to be located with great accuracy.

In view of some recent unfortunate accidents, I think that your readers may like to know that this instrument is now available.

It would be a very simple matter for gas companies in whose area there are roads with waterproof crusts to arrange for a number of small vent plugs at suitable distances along their gas-mains. By means of the "B.H." gas-leak detector any accumulation of gas can easily be detected.

It is quite an easy matter to design a suitable plug which would remain permanently in the road surface, and which would pierce the concrete without interfering with the existing surface to any appreciable extent. The instrument is very simple to use, and is not costly—in fact, by avoiding loss due to leakage, it is an extremely profitable investment for gas companies.

Westminster, Jan. 22, 1923. C. B. Tully.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 17.]

Nos. 563 to 1233.

Barraclough, N.—"Jigging-type conveyors, screens, &c." No. 573.

Burt, Boulton, and Haywood, Ltd.—"Preservation of timber with creosote." No. 748.

China, F. J. E.—See Burt, Boulton, and Haywood, Ltd. No. 748.

Cowan, Sir H.—"Wet gas-meters." No. 1017.

Doyle, J.—"Lighting fixtures." No. 793.

Duckham, Sir A. M.—"Method of briquetting fuel." No. 1123.

Evans, E. V.—"Manufacture of fuel." No. 1228.

Forder, E.—"Equalizing valve for gases and liquids." No. 709.

Industrial Research, Ltd.—"Recovery of ammonia from gases." No. 910.

Inkley, B.—"Mechanism for controlling flow of fluid." No. 842.

Jenkins & Co., Ltd., W. J.—"Apparatus for quenching coke." No. 781.

John, A. E.—See Inkley, B. No. 842.

Johnson, R. M.—See Burt, Boulton, and Haywood, Ltd. No. 748.

Koppers Company.—"Regenerative heating apparatus." No. 772.

Koppers Company.—"Purifying gases." No. 780.

Liese, H. [Firm of].—"Measurement and regulation of pressures or specific weights of gases, fluids, &c." No. 877.

M'Intyre, J.—"Prepayment mechanism for gas meters, &c." No. 839.

Milne & Son, Ltd., J.—See M'Intyre, J. No. 839.

Neath, J.—"Gas-retorts." No. 1130.

Parkinson and W. & B. Cowan, Ltd.—See Cowan, Sir H. No. 1017.

Reinheimer, C.—"Apparatus for absorbing fumes from gas, &c., heaters." No. 892.

Roxburgh, R. L.—"Oil or gas stoves." No. 818.

South Metropolitan Gas Company.—See Evans, E. V. No. 1228.

Stimson, E. F.—"Water-heaters." No. 736.

Stimson, E. F.—"Gas-pressure controllers." No. 855.

Strong, H. O.—"Gas-fires." No. 695.

West, E., F. J., and West's Gas Improvement Company, Ltd.—"Gas-producers." No. 890.

Williams, R. A.—See Jenkins & Co., Ltd., W. J. No. 781.

Woodall, Duckham, and Jones (1920), Ltd.—See Duckham, Sir A. M. No. 1123.

Wright, J. J.—"Burners for gas-stoves." No. 833.

Accident at a Birmingham Gas-Works.—An accident, attended by fatal results, occurred at the Saltley (Birmingham) gas-works on Tuesday of last week. The unfortunate workman was Arthur Henry Wyatt (63), fitter, Washwood Heath Road, Birmingham; and it was stated at the inquest on Friday that Wyatt, who had been an employee of the Gas Department for 33 years, was taken home by a fellow-workman on Tuesday evening. The latter said that Wyatt was walking along a wall when he fell a distance of about 6 ft., injuring his left side. He did not think he was seriously injured, and had expressed his intention of returning to work on the following day. He died on Thursday. Medical evidence showed that he had sustained four fractured ribs, death being due to shock following the injuries. The coroner recorded a verdict of "accidental death."

Skipton Gas Management.—Mention was made in last week's "Journal" of the fact that there had been disagreement between some members of the Skipton Gas Committee and Mr. J. H. Woodward, the Gas Manager, and that the Local Chamber of Trade had expressed great confidence in Mr. Woodward's management. We are now pleased to learn that at a special meeting of the Gas Committee last week Mr. Wilson (Chairman of the Gas Committee) withdrew the Committee's resolution that Mr. Woodward be asked to resign the position of Gas Manager. He stated that his reason for doing so was the fact that the gas supply had been greatly improved during the past two months. It was unanimously decided, after a long discussion, that Mr. Woodward's services be retained, and it was hoped on all sides that the past trouble in connection with the undertaking would be wiped out, and that there would be more harmonious working between the Committee and the Manager in the future. During the proceedings, Mr. Woodward declared that they could not find another gas undertaking in the United Kingdom, anywhere near the size of that at Skipton, which could produce better financial results than he had done since he became their Manager.

MISCELLANEOUS NEWS.

THE THERM INQUIRY.

Fourth Day.

Tuesday, January 16.

The fourth meeting of the Committee appointed by the Board of Trade to inquire into the method of charging for gas on the therm basis was held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, on Tuesday of last week. (The previous proceedings were reported in the "JOURNAL" for Dec. 20 and 27, pp. 743, 804, and last week, p. 146.)

The Chairman of the Committee is Sir CLARENDON G. HYDE; the other members being Mr. ARTHUR BALFOUR, J.P., Sir JAMES MARTIN, J.P., Mr. W. J. U. WOOLCOCK, C.B.E., and Mr. A. PUGH.

AN EXPLANATION BY THE CHAIRMAN.

The CHAIRMAN, at the outset, made it clear that the Committee were not concerned in any way with the constituent elements of gas supplied, nor with the composition or quality. The Committee were limited strictly to inquiring into the therm as a basis of charge. The members of the Committee had considered it their duty to inquire into the question of pressure, having regard to the fact that the gas undertakers were permitted to fix their own calorific values; but they were not prepared to enlarge on that.

With regard to the invitations which had been extended to over 100 local authorities in the area of Greater London to give evidence before the Committee, up to the present only four desired to offer evidence; 31 did not wish to do so; 33 had acknowledged the Committee's communication, but had given no definite answer; four had protested against the therm method of charge, but did not wish to offer evidence; and 30 had not replied at all. As in the case of the Chambers of Commerce of Glasgow, Sheffield, Newcastle, and Liverpool, the London Chamber of Commerce did not wish to offer evidence.

Continuing, the Chairman said that Prof. W. A. Bone (Professor of Chemical Technology, Royal College of Science and Technology, South Kensington) had written a very interesting letter to the "Times," which was published on Jan. 12, dealing with the dangerous constituents of gas, and had wound up by saying: "In conclusion, it should be pointed out that the matter hardly comes within the scope of the Therm Committee's present inquiry, which, unfortunately, seems to be diverting public attention from the really vital issues concerning gas. No well-informed person wants to upset the present therm system, provided that for the future it is coupled with a reasonably high volumetric thermal standard, of (say) not less than 500 B.Th.U. per c.ft. The therm is a most innocent and estimable youth, of pious parentage and upbringing, who has, unfortunately, been turned loose into a particularly wicked world, without knowing the difference between a ten and an ace. It is to be hoped that the Committee now charged with his interests will be able to show him how easily 'evil communications corrupt good manners.'" The Committee had invited Prof. Bone to explain exactly what he meant by this. He had pleaded, however, pressure of other engagements. [Laughter.] Therefore, this must be regarded as simply a specimen of misdirected humour.

Dealing with further communications received by the Committee, the Chairman said they had heard from the Richmond Council that the result of a conference with the Barnes, Twickenham, and Hanwell Urban District Councils was that they did not desire to give evidence, although they had considered the standard price too high. The Mitcham District Council thought no charge could be made out against the therm basis, but that the standard price was too high. There were also letters from private consumers, one of whom desired that the system of charge per cubic foot should be reverted to; while another had written in favour of gas supplied by the Hornsey Gas Company.

QUESTIONS AFFECTING THE PRICE OF GAS.

Mr. WILLIAM CASH (of Messrs. Cash, Stone, & Co., Chartered Accountants, and President of the Institute of Chartered Accountants) gave evidence, and mentioned that he was Chairman of the Bournemouth Gas and Water Company, a Director of the Croydon Gas Company, Chairman of the Worthing Gas Light and Coke Company, Chairman of the South African Lighting Association, and other companies. He is also Auditor to a number of gas companies. His evidence was directed to the method of charge on the therm basis brought into force by the Gas Regulation Act, and its effect on the gas companies and the public. The principle involved was to continue the measurement of the gas supplied by volume, and to base the charge on the heat value supplied, such heat value being the essential requirement under modern conditions. The effect was two-fold. First, to make the price, as measured in heat value, comparable between one company and another, and secondly, to afford elasticity to the companies in the quality of gas supplied. As to the former, while a comparison on a scientific basis was now possible, it was most important to remember that the conditions applicable to the various undertakings were very different, due to the circumstances affecting each undertaking, mainly in its geographical situation, and facilities available for the transport of the raw material, coal and oil, &c. As an example of adjacent towns having totally different facilities, Mr. Cash mentioned Brighton, where water carriage alongside the works is available, and Worthing, the next town, where coal had to be brought by rail from the colliery in the Midlands to the railway station, and then carted into the works. Again, the market for residuals varied enormously in different towns. Whereas coke was sent from London into the country, at Bournemouth the total make of the gas-works was insufficient to supply the immediate local requirements. These circumstances affected the price which could be obtained for residuals. With regard to elasticity, the nature of the town and the fittings in the houses, the demand for industrial purposes, and the adequacy of the distribution system might demand a high calorific value; while in another town an up-to-date distribution system and modern appliances would enable a lower calorific value gas to be supplied with satisfaction to the consumers. A lower calorific value, if calculated in cubic feet, was cheaper to supply than a higher calorific value.

After pointing out that the Board of Trade had given most careful consideration to all cases before them, and had taken all possible steps to safeguard the public in fixing new standard prices, and expressing his opinion that there was no ground for the complaints in the Press that the consumer was prejudicially affected by the new system of charge, Mr. Cash dealt with the experiences of the Croydon and Bournemouth Companies. In the case of the Croydon Company, they had obtained an Order under the Gas Regulation Act on March 23, 1921. The declared calorific value from Lady Day, 1921, was 470 B.Th.U., and the Company had decided, from Jan. 1 last, to increase this to 500 B.Th.U. In the case of the Bournemouth Company, an Order was obtained on Dec. 23, 1921, which came into force on the following day. In that case, a 450 B.Th.U. gas was supplied with satisfaction to the consumers; and the Company had decided to continue at that. Figures were handed in showing the quantity of gas sold quarter by quarter by the Croydon Company from Lady Day, 1921, to Midsummer, 1922, as well as a statement showing the price charged, given in both cubic feet and therms. The price per 1000 c.ft. had risen from 2s. 6d. to 4s. 3·7d. from 1917 to 1922. Mr. Cash mentioned that the price at Croydon was reduced to 10d. per therm from Jan. 1. A table of mean temperatures for each fortnight over the period 1921 and 1922 was also handed in, showing that the temperatures from April to June, 1922, were lower than in the corresponding quarter of 1921. In the quarter ended June, 1921, there was a decrease in sales, due to enforced economy in consumption during the coal strike and to the warm, dry weather of 1921. The number of consumers had increased from Lady Day, 1921, to Midsummer, 1922, from 49,719 to 52,103; and the consumption per ordinary consumer at Midsummer, 1922, had gone up.

As to the methods adopted by the Company to educate consumers when the charge per therm was first instituted, Mr. Cash said that notices were sent to all consumers; and he produced copies. He also showed copies of the bills as rendered, and drew attention to the conversion table printed on the back of the bills, which made it abundantly clear to the consumer how the charge was arrived at. About half the total number of customers were ordinary consumers, and about half were supplied on the prepayment system. The meter card also contained instructions for reading the meters and for converting cubic feet into therms. The new system could be easily understood by consumers with the aid of the meter card and the demand note, if they took the trouble to understand it. The alteration to the therm system, explained as it had been to the consumers, had not brought any appreciable number of complaints. There had been some inquiries asking for further explanation; but there was no substantial difficulty of any sort resulting from the change.

The CHAIRMAN, after examining the demand notes and the meter card, said it seemed that the Croydon consumers had all the information they might reasonably require.

Questioned with regard to pressure at Croydon, Mr. Cash said that it varied; but the Company gave more than the minimum pressure required over the whole district. There was a system of increasing pressure from the works in order to give an adequate pressure over the whole district. Tests were going on continuously, as was also the laying of mains where necessary to enlarge them in order to provide adequate pressure. Tests showed there was a pressure of 45-10ths in outlying parts of the district. With regard to governors, he believed they were fixed in some houses. They had been fixed at the desire of consumers in certain houses; but they were not universal. He had not found that consumers, once they had governors, wanted to get rid of them.

Discussing the practice of the Company with regard to appliances, Mr. Cash said they undertook the maintenance of incandescent burners at a charge of 2d. per burner per quarter. The staff took the burners home and cleaned them, and saw that they were properly adjusted, &c. An extra charge was made at practically cost price for materials for renewals and repairs. A fair number of consumers availed themselves of this system. As to gas-fires, a register was kept of all fires, whether owned or hired; and they were attended to at least once every year without charge, when they were thoroughly cleaned, adjusted, and tested. Renewals were also made at cost price. There was a large staff continually going round the district. The policy of the Company was to provide every possible facility for giving satisfaction. They spent a great deal of time and money in seeing that customers obtained the greatest possible use out of the gas. The change from a 470 to a 500 B.Th.U. gas would not necessitate readjustments of fittings. With regard to piping, in the modern houses, where the Company were in touch with the builders and were able to give advice, they saw that proper pipes were supplied and that there were proper appliances. The gas was tested by the Corporation; and the results of the tests last September and December were published in the local paper as display advertisements, because it was felt that it would give satisfaction to consumers to know that the tests were entirely satisfactory. The official testing-station was not at the works, but nearly a mile away.

The CHAIRMAN stated that a letter had been received from the County Borough of Croydon; and while they did not desire to offer evidence, two points were mentioned. First, that while the method of charging for gas by the therm was theoretically desirable, it was found in practice, owing to want of knowledge or sufficient attention on the part of the consumer, that an increase in the thermal value of gas supplied did not lead to a decrease in the number of cubic feet consumed. Secondly, that many of the burners in use needed adjusting on every change in the thermal value of the gas supplied, and that these changes were not, or could not be, made by the ordinary consumer, and were not in fact made by the Gas Company in accordance with the provisions of the Act, because the consumer made no request.

Mr. CASH did not agree with regard to the first point. The answer to the second was that an opportunity was given to the consumers of having burners regulated at a trifling cost.

Dealing with Bournemouth, Mr. Cash said the Company supplied both gas and water, and, inasmuch as they had no power to increase water charges during the war, that had some effect on the price charged for gas. They were a sliding-scale Company; but only a small proportion of the capital was on the sliding-scale—namely, £100,000, out of a total of £1,114,000. He handed in statements similar to those of Croydon. It was seen that in 1911 the calorific value of the gas was 522 B.Th.U., but had gradually fallen to 450 B.Th.U., the present figure. The price charged from March, 1911, was 2s. 6d. per 1000 c.ft., which continued until the war. This had been increased subsequently, and had fallen again to the equivalent of 3s. 10·8d. in October, 1922; and from Jan. 1 last, the price was 3s. 4·5d. The prices in therms were 5·75d. in March, 1911, 11·4d. in July, 1922, and from Jan. 1 last 9d. The 450 B.Th.U. gas supplied had given satisfaction, and was the cheapest gas per therm to manufacture with the plant installed. There was a minimum pressure of 25·10ths at the worst hour of the week; and if the pressure between 12 o'clock and 1 o'clock on Sundays (the time of the peak load) dropped below this figure in any district, immediate steps were taken to add to the main connections and improve the supply. The minimum pressure in the greater part of the Company's area was 40·10ths. Bournemouth was a modern town which had grown enormously during the last few years, and the appliances were more generally modern than they would be, perhaps, in Croydon, which was another factor in connection with supplying gas of 450 B.Th.U. As to maintenance of apparatus, this was done very much on the same lines as at Croydon. The arrangements were the similar with regard to burners. No fires were hired; but maintenance was undertaken at a small charge, including adjustment, if desired by customers. In the case of both companies, they relied on complaints with regard to cookers, which received prompt attention. Circulars sent to consumers with regard to the change-over to the therm system were much the same as those issued at Croydon. The Company had 15,000 ordinary and 17,000 prepayment consumers, and had received about 20 letters of complaint with regard to the therm system since its introduction. A number of these obviously had no real complaint to make. No change was made in the calorific value of the gas supplied when the therm system was introduced, and notices advertising reductions in the price of gas had given the equivalent reductions and prices on the cubic foot basis, so that consumers could compare present prices with pre-therm prices. The results of tests made by the gas examiner had been uniformly satisfactory. Mr. Cash pointed out that the concern was a commercial undertaking in competition with others; and the staff were anxious to satisfy consumers.

With regard to the Worthing Company, it had been decided, from April 1 next, to alter the declared value from 470 to 500 B.Th.U. Although only 470 B.Th.U. was at present declared, they were, in fact, supplying 480 to 490 B.Th.U., this being done in order to remedy complaints, mainly as to naphthalene. Worthing had always been accustomed to a very high value gas. It was a different class of town from Bournemouth, and no doubt the type of fittings and distribution service, although being rapidly improved, was not entirely modern in character.

Dealing with the Tottenham District Light, Heat, and Power Company (to which he was Auditor), Mr. Cash said that the value of the gas supplied had been increased from July 1, 1922, from 450 to 500 B.Th.U. He had ascertained the figures relating to the sale of gas after the increase in calorific value, which illustrated the effect of the alteration. These showed a decrease in cubic feet of 12·62 p.ct., and a decrease in therms of only 2·91 p.ct. in gas sold ordinarily and in automatic meters. The figures were as follows:

Michaelmas Quarter.	Cubic Feet.	Therms.
1922	488,457,200	2,442,286 (500 B.Th.U.)
1921	559,025,900	2,515,616 (450 ,,)
	70,568,700	73,330
	Decrease. 12·62 p.ct.	Decrease. 2·91 p.ct.

The figures as regards the automatic meters were somewhat distorted by the alteration in price concurrent with the increased thermal value; but, of course, this was mere arithmetic. If the sales were ignored, and the total output was considered, then the figures showed a decrease of 3·46 p.ct. in cubic feet., but an increase of 7·26 p.ct. in therms. This last figure agreed very nearly with the average rate of increase one year over another taken over the last six years, which has been at the rate of 7½ p.ct. in cubic feet. If this were regarded as a fair test, it would seem to show that the normal rate of increase measured in therms had been maintained, but that a smaller quantity of cubic feet was required to perform the same duty if gas was of a higher thermal value. This went to show that the basis of selling per therm was right and fair.

Replying to the suggestion by Sir JAMES MARTIN, that the public did not have sufficient information on the subject originally, Mr. Cash remarked that in his own companies special pains were taken to explain the matter to the public.

Sir JAMES MARTIN asked whether a good deal of trouble was not due to the fact that, whereas gas undertakers had to adjust consumers' appliances when an alteration in the declared calorific value of the gas was made, there was no necessity for them to do so originally, when the new regulations came into force and the calorific value was declared.

Mr. CASH'S experience was that in fact the companies did not alter the character of the gas supplied when Orders were first obtained, and that, therefore, no adjustment was necessary.

Sir JAMES MARTIN said witnesses had stated that gas companies wanted to give the consumer all that he could reasonably demand, and suggested that it was not an unreasonable demand that the date should be put on the account, as was done at Croydon.

Replying to questions put by Mr. PUGH, as to whether the number of tests made per quarter was adequate to protect consumers' interests, Mr. Cash said that at Croydon tests were made every day, and he believed this was also the case at Bournemouth. He drew attention to the penalties for falling below the standard.

ILFORD COUNCIL'S VIEWS.

Mr. W. R. HERRING then gave evidence on behalf of the Ilford Urban District Council. The Council considered the present standard price too high, and that the Board of Trade should have power to alter the original statutory standard price. He approved of the method of charging by the therm. Witness said that local authorities were supplied with schedules and statistics and other information on which companies based their estimates of costs; but these did not contain the information necessary to enable local authorities to arrive at proper conclusions as to the reasonableness or otherwise of the companies' estimates. In the past the Council had not the material on which to decide whether they should make application to the Board of Trade to reduce the standard price, and the material was not available even to day. The schedules gave money values only and not quantities; and it was desired that the companies should be required to supply more information. As to the original standard price, statutory authority should be given to enable that to be revised, in accordance with the circumstances of the time.

Asked by Mr. BALFOUR whether the Ilford Council had made an application to the Board of Trade for a revision of price, witness said he had advised the Council to await the publication of the past year's accounts.

Mr. WOOLCOCK referred to a remark made by witness in a statement he handed to the Committee, to the effect that many companies would be in a position to distribute larger profits to the shareholders arising solely from the economy accruing by manufacturing a lower quality gas than that upon which the original standard price was based, and asked whether the quality of gas, generally speaking, was going up or down.

Mr. HERRING replied that at present qualities were rising slightly; but going back 20 years—and many of the prices were fixed prior to that—the quality of gas had been reduced 25 or 20 p.ct. He agreed that in some cases it might be more economical to manufacture a high than a low grade gas.

Mr. MARLOW (Assistant Secretary, Institute of Chemistry of Great Britain and Ireland) gave evidence on behalf of that body and of the Institute of Physics. The Gas Regulation Act, he said, provided for no special qualifications for gas examiners; and he handed to the Committee a copy of the following resolution recently adopted by the Council of the Institute of Chemistry and the Board of the Institute of Physics, on this subject:

> That the Council of the Institute of Chemistry and the Board of the Institute of Physics urge the authorities concerned to require that the qualifications of gas examiners should be defined as follows:
>
> (A) Attainments.
> 1.—Fellows or Associates of the Institute of Chemistry. Fellows or Associates of the Institute of Physics.
> 2.—Any graduate of a recognized University who has taken chemistry and physics in the final examination for his degree.
> 3.—Associates of recognized technical colleges, provided that their diplomas include chemistry and physics—such as the Royal College of Science, the Royal School of Mines, the City and Guilds Central Technical College (incorporated in the Royal College of Science); Finsbury Technical College, Technical College, Bradford, Heriot-Watt College, Edinburgh, Manchester College of Technology, and University College, Nottingham.
> 4.—Qualified engineers with adequate training in chemistry and physics, certified by a recognized University or College.
>
> (B) Experience.
> A candidate for a gas examinership must produce evidence of having actual experience of the work, obtained under qualified supervision, and he must be fully cognizant of the laws and regulations relating thereto.
>
> (C) Professional standing.
> It is desirable that a gas examiner should be a member of a reputable professional body of chemists, engineers, or physicists.

The Committee would realize, he said, that the Gas Regulation Act would be a dead-letter unless the persons appointed as gas examiners were qualified to undertake the duties entrusted to them. Already, the Institute of Chemistry had received information to the effect that a number of employees of local authorities, and other persons having no special knowledge or experience of the work, had been appointed to these positions; and there appeared to be no mechanism whereby the suitability of appointments made might be challenged. The Act made quality the basis of charge for gas; and the public would only be satisfied with the working of the Act if they were assured of the competence and impartiality of the examiners. The Gas Referees had no power to do more than advise.

Sir JAMES MARTIN raised the question as to the definition of qualifications.

WITNESS admitted that as the Act stood at present there was nobody to define them. He suggested that it should be left to some authority (such as the Gas Referees) to define what was the necessary evidence of competency. In reply to further questions by Sir James Martin as to who would leave it to the authority mentioned, because there must be some authority for the alteration, witness agreed that this must come from some amendment of the Act.

CONSUMERS' COMPLAINTS IN SUNBURY AND CHELSEA.

Councillor A. BALL (Sunbury Urban District Council) said his district was supplied by the Brentford Gas Company. He represented the private consumers, who wished it to be stated, through the Council, that the therm system led to a great deal of confusion in the

checking of their accounts. During the past twelve or eighteen months a larger number of meters in the district were out of order than ever before; and the consumers had it in their minds that this might be due to the fact that gas was supplied on the therm basis. [Laughter.] Expert advice had not been taken by the Council on the matter, and there was nobody on the Council who understood gas engineering. He mentioned that one large consumer in the district had said that his consumption of gas for the quarter ended December, 1922, was three times that of the corresponding period of last year, which he was positive was not accurate. Where meters registered below the average consumption, they were very quickly removed and tested; but when they registered a higher consumption, no steps were taken.

The CHAIRMAN said that was a matter for the consumer. He pointed out that the Brentford Company sent out demand notes showing the number of cubic feet, and the price, as well as the number of therms and the price; so that consumers obtained all the information.

Replying to Mr. PUGH, witness said there had been a very large number of complaints that burners were not working satisfactorily.

In answer to Mr. WOOLCOCK, who suggested that he did not really think it made the slightest difference to the meter whether gas was charged for by the therm or not, witness said he was not an engineer; but the impression among consumers was that the gas, being of greater heat, was probably affecting the meters. The gas supplied in the district was considered to be very much hotter than it was previously. [Laughter.]

Mrs. FELTHAM (a householder, of No. 3, Tadema Road, Chelsea), who is supplied by the Gas Light and Coke Company, produced her meter cards showing consumptions from 1914 to 1922. Up to 1921 the consumption was much the same for the June quarter of each year; the figure being between 2000 and about 2600 c.ft. From the end of the March quarter until May 11, 1921, the consumption was 1200 c.ft. The therm was then introduced, and there was an additional 1800 c.ft. consumed; making 3000 c.ft. for the June quarter. For the June quarter of 1922 the consumption was 4000 c.ft. Witness said she was not using her gas-stove now, owing to the increased consumption, and the light in one bedroom was not used since the introduction of the therm; but in spite of economy the gas bills went up.

Mr. F. W. GOODENOUGH (Gas Light and Coke Company) promised to have inquiries made, and to report the result to the Committee.

Mrs. FELTHAM drew applause from members of the audience who were presumably consumers when she said that when meters registered a smaller amount of gas than usual the Company examined them for their own benefit, but when they registered more it was quite all right. Continuing, she said it was to the consumers' advantage that the therm system should be done away with, adding "We mothers do not like it." She was speaking for many small consumers in Chelsea. With regard to paying for heat, she asked, "Do we want heat for a kitchen light when we have a kitchen range? We do not want heat in the street lamps; it is altogether wrong."

With regard to the promise that Mrs. Feltham's gas-cooker would be tested, she pointed out that now that she had bought it she would have to pay. On being assured by the Chairman that she would not on this occasion, she replied that she did not care whether it was tested or not, because she had done with the gas-stove.

SOUTHALL'S OBJECTION.

Councillor REGINALD BROWN gave evidence on behalf of the Southall Urban District Council. He had formerly been Engineer to the Council. He considered that the charge per 1000 c.ft. was infinitely better than the therm, because people understood it better. The womenfolk had to tackle the question in most districts, and did not understand the conversion.

In reply to the CHAIRMAN, witness said he approved of the system scientifically. His point was that the cubic feet basis of charge might have been retained and the gas sent out at a certain thermal value. In the district there were some 4000 prepayment consumers out of about 6000. He emphasized the need for educating the public. Pre-war the gas cost 2s. 4d. per 1000 c.ft. At present it was equivalent to 4s. 2½d.; and he was afraid the inhabitants of his district would not rest satisfied knowing there was such a tremendous increase in the price. He agreed that the price of coal had gone up, but so also had the price of residuals.

Mr. A. A. JOHNSTON (the Engineer and Manager of the Brentford Gas Company), replying to a point raised by the witness as to the pressure not being the same in consumers' premises as at the testing-station, said that the gas sent out from the works was continuously tested throughout the twenty-four hours, and there could be no change between the testing-station and the point of consumption. The pressure had never been below the 2 inches specified.

Replying to the CHAIRMAN, witness stated that if the bills contained the price per cubic feet as well as the price per therm, it would satisfy him; but he did not think it would the consumers. Continuing, if the pressure and the calorific value at the consumers' meters was the same as at the works, there should be no difficulty in charging per 1000 c.ft.

Sir JAMES MARTIN, referring to witness's remarks about the increased price of gas, pointed out the rise in the cost of labour.

In reply to Mr. PUGH, witness said if there was no drop in calorific value between the works and the meters, let the public be assured that there was not.

Mr. JOHNSTON assured the witness, without hesitation, that there was no drop in the quality of the gas between the point of test and the consumers' meters, and there need be no fear in that regard.

Councillor BROWN said he wanted to get that on the minutes of the Committee's proceedings, and it would go out from him at an open Council meeting. That would satisfy him.

Mr. JOHNSTON pointed out that the wages bill at Southall had increased from £45,000 in 1914 to £158,000 in 1922, and suggested that this was a good reason for an increase in the price of gas.

Asked what was the increase in rates in Southall, witness said he believed the district rate had increased from 3s. 6d. to about 7s. 6d. or 8s., which was more than 100 p.ct. At the same time, the Gas Company had had a considerable reduction of their assessment.

Mr. JOHNSTON said the Company's rates were practically double what they were before the war. Also, reinstatement charges had increased by 616 p.ct.

WITNESS said that in pre-war days Mr. Johnston was not paying anywhere near the proportion he ought in this connection.

Mr. JOHNSTON pointed out that similar work was carried out cheaper elsewhere, even in pre-war days.

With regard to quality, he explained that there had been no change in the quality of the gas supplied by the Company since 1914. At present the gas was 460 B.Th.U., and had not varied more than 20 B.Th.U. throughout the war. The composition of the gas was also the same.

A GAS REFEREE'S EVIDENCE.

Mr. W. J. A. BUTTERFIELD (a Gas Referee) said there was nothing to substantiate the statement that there was any falling off in the calorific value of the gas between the works and the point of consumption that was measurable with certainty. The Gas Referees had, in two or three instances outside London, put testing-places six or seven miles from the works, and had compared the figures obtained there with those obtained at the testing-places on the works. In one such case in last quarter's return, the average of the figures at the testing-place six or seven miles from the works was some five or six units above that obtained at the works. He believed it was simply the margin of the testing, and possibly that the times did not coincide exactly. The limit of accuracy, unless a very large number of testings was made, was about five or six units.

As to Mr. Marlow's remarks on the competency and impartiality of gas examiners, Mr. Butterfield said it was difficult for the Gas Referees to judge of the competency of the men appointed, because they had not seen them. If a man had been an Inspector of Weights and Measures, and had been testing the gas for a number of years for a local authority, he had learned his work, and witness would be sorry to say that he was not as competent as a highly-trained man, so long as the routine was substantially the same. He believed it would be very much better if well-trained men were secured in all cases. He pointed out that if the Referees had reason to suspect the accuracy of reports, they communicated with the gas examiners concerned. He had not come across results of tests which were grossly inaccurate; but the Referees had not all the material to enable them to judge whether reports were grossly inaccurate. He agreed with the Chairman that the public were very much at the mercy of the examiners; but with the present apparatus there was no real ground for supposing that the results so far obtained were not trustworthy. So far as his knowledge went, the gas examiners throughout the country were not unsatisfactory. He explained the powers of the Referees with regard to issuing special prescriptions for testing for pressure, if there were reason to believe it was inadequate.

In reply to questions as to whether thirteen tests per quarter were adequate (this was the number prescribed at York, referred to by Mr. J. Triffitt, in evidence—see "JOURNAL," Jan. 17, p. 146), Mr Butterfield said thirteen tests might not be enough in particular circumstances. The Referees' difficulty had been to get local authorities to consent to meet the expense of a greater number of testings.

As to the object of giving notice to companies that a test was to be carried out, in cases where the testing-place was not on the works, he believed this was put in the Act because the company had a right to be present. The Referees were hampered because they felt they could not prescribe more than two tests per quarter in the case of certain small undertakings, on account of expense. In fact, one local authority had appealed to the Referees to make it only one per quarter, on the ground that the two per quarter meant an addition of ½d. in the pound on the rates.

With regard to the adjustment of burners, for variations of gas between 475 and 560 B.Th.U., there should be no difficulty in adjusting apparatus in common use. He excepted the non-adjustable burners used in the area of the South Metropolitan Company. As to a governor, this would be an advantage to a consumer if his consumption were almost wholly for lighting, and the lights were nearly all burning at the same time. In the case of a railway company, where lights were burning for a long time, a service governor was essential, but, generally speaking, in nearly all other cases it was a nuisance.

Replying to questions with regard to undertakers having decreased the calorific value of gas supplied during the war, and having enlarged the orifices of burners to meet the new conditions, witness said it was possible that some of the complaints as to increased consumption had been due to a reversion to something approaching the pre-war grade of gas without the necessary readjustment of the apparatus. The gas companies, he added, had made war-time adjustment against their better judgment. As to meters, some undertakings changed these every five or six years; and this should be made general. He believed that as a rule the old meters worked to the disadvantage of the undertaking, although it was possible that there were instances where it was the other way about. The periodical change would be advantageous, and would recoup the undertaking for the expense incurred. Meters should have a fresh certificate of accuracy every seven years. He believed it would satisfy consumers if meter cards were made universal, so that they could compare consumptions without having to look through a pile of old bills. There were a large number of undertakings without meter cards. The card should, under present conditions, show cubic feet and therms, and might with advantage be supplemented by a sort of delivery note, showing the amount of gas used. Many consumers did not know when the meter reader came; and the latter should make out a slip of paper showing the consumption, to be handed to the consumer. He also suggested that ordinary meters should be read twice a quarter, and half-quarterly bills sent if consumers required them. Owing to the increased consumption of gas in most households, the amount of the gas bill tendered once a quarter was a considerable item, and often provision was not made to meet it. He did not suggest that half-quarterly accounts should be rendered, but the consumer should be allowed to pay every half-quarter if he desired to do so.

Questioned by Sir JAMES MARTIN as to the provisions of the Gas Regulation Act, which laid down that local authorities might appoint "competent and impartial" gas examiners, witness said the words

were lifted from older Acts. He believed there would have been considerable resentment by local authorities if it had been suggested that they should be dictated to as to whom they should appoint. With regard to credit, a man was getting more credit for gas than he was accustomed to in any other direction. As to the cost of keeping half-quarterly records of consumption, which was done by some undertakings, there must be some regard to economy; but if the cost were worked-out in relation to the quarterly gas bill it would only amount to a penny or two on a bill of (say) £5.

Mr. PUGH, speaking with regard to the appointment of gas examiners by local authorities, said that if there was a grievance on the part of consumers it was against their own local authority rather than against the Gas Referees, who had no veto on the appointment.

Mr. BUTTERFIELD said that in many cases the Referees had to urge local authorities to appoint examiners. He mentioned the case of York, where the Corporation had written to say they did not propose to appoint an examiner. There was correspondence between the Corporation and the Referees; and after some months' consideration, the former appointed an examiner. He felt sure that if the Referees had prescribed more than thirteen tests a quarter the Corporation would have said the expense was too heavy. He handed in the correspondence, and said the Referees hoped to get more testings later. He mentioned another case which is now under consideration, where the local authority said they could not carry out the number of tests the Referees wished to prescribe; but it was hoped to convince them that they should do more. The Act came into force when local authorities were cutting-down expenditure. The Referees had no remedy if the local authorities said they would not have more than thirteen tests a quarter; but the consumers had through Quarter Sessions.

THE VIEWS OF SIR DUGALD CLERK.

Sir DUGALD CLERK, F.R.S., said he represented the point of view of the user. He called attention to the work he had done in connection with the internal combustion engine since 1877, and to the studies which he had undertaken continuously since then upon coal gas, blast-furnace gas, and producer gas, and to the fact that he had had occasion to study incandescent lighting in addition to gas-engines. He had long advocated the production of a gas of high flame temperature suitable for gas-engines, furnace work, and boiling and cooking operations; and at one time the gas industry regarded him rather as a nuisance, because he had pressed for a 600 B.Th.U. gas at 1s. 6d. per 1000 c.ft. At that time, the gas industry did not quite share his views, although they came round to them later. In 1892, in a paper, he suggested that if a 600 B.Th.U. gas could be sold for 1s. per 1000 c.ft., the gas industry would be able to keep the whole of the gas-engine trade to itself. At that time, gas-engines were just emerging from the small stage, and users were beginning to find that the prices charged by the gas companies per heat unit were too high.

The CHAIRMAN: You still believe in the heat unit?

Sir DUGALD CLERK replied that no scientific man could believe in anything else. In 1905, in a paper before the North of England Gas Managers' Association, he suggested that the illuminating standard for gas should be abandoned, and the heat basis adopted. It was in 1909 that the first Act dealing with this was passed. At the time he originally made the suggestion, he had taken 10,000 B.Th.U. as the unit. This was just one-tenth of the present therm, and he had shown that if a gas of 650 B.Th.U. per c.ft. (which was the standard at that time) could be supplied at 1s. per 1000 c.ft., which would be the equivalent of 2d. per therm, or even at 1s. 6d. per 1000 c.ft., which would be the equivalent of 3d. per therm, then the gas industry would be able to defy competition from any other form of power. Unfortunately, this was not possible, and gas-engine users were forced to design producers for themselves whenever the engines exceeded 50 H.P.; and a very great industry had arisen in gas producer plants. He handed to the Committee a copy of a lecture he had given at a meeting of the Royal Institution, in which were indicator diagrams showing that low-grade and high-grade gas can be used equally economically in gas-engines under suitable conditions.

The CHAIRMAN: You mean that industrially you can adapt a gas-engine to take any calorific value gas?

Sir DUGALD CLERK said that was so; and to make the point clear he handed in figures showing the heat values of different gas and air mixtures. The peculiar point was that flame temperature did not depend upon the number of British thermal units. As an instance, he mentioned that he had taken a Sheffield gas and added 4 p.ct. to the ordinary quantity of inerts, and the flame temperature only dropped about 10 degrees, which was immaterial from the point of view of gas-engine working. So far as gas-engines were concerned, he had found that using gas of from 600 B.Th.U. down to 100 B.Th.U., it was possible to get all the flame temperature that was required. As a matter of fact, there was a slight disadvantage in using a high calorific power gas in engines, because in aiming to get the highest economy from them it was necessary to put up the compression ratio. The best figure for the latter was 1 to 7. With coal gas and such a compression ratio, there was a tremendous knock in the engine. Therefore, with rich coal gas it was necessary to reduce the compression ratio, so as to keep below this detonating point. With Mond gas, which had a certain proportion of carbonic acid in it, a compression ratio of 1 to 8 could be used without any detonation, and gas-engine builders preferred to use the lower-grade gases with more carbonic acid in them, because the advantages to be gained more than off-set the slight diminution in flame temperature. In all this, of course, he was speaking of the use of low-grade gas for engines.

Coming to incandescent lighting, Sir Dugald said he had been engaged in connection with the Welsbach litigation some years ago, and had made many experiments to determine the flame temperature used in incandescent gas lighting. It was rather a difficult technical matter, into which he would not go in detail; but he came to the conclusion that it was necessary to have a flame temperature between 1800° and 2000° C. to get the maximum duty out of incandescent gas lighting. It was possible to get that flame temperature with a 300 B.Th.U., or pure, water gas; and in the case of coal gas, mixed with a proportion of water gas, the flame temperature was constant at the required figure for anything between 600 and 400 B.Th.U. gas. Below that quality the flame temperature fell off slightly. Thus the thermal efficiency depended to a large extent upon the nature of the mixture of gas and air, and also upon the pressure at which it was supplied. The original incandescent mantles were supplied at a pressure of two or three inches; but in the case of modern street lamps, by increasing the pressure to fifteen or twenty inches, something like 20 to 30 p.ct. more illuminating power was obtained. Generally speaking, however, it was possible to go down to 300 B.Th.U.; but below that the mixture would be too weak. The whole subject had been very thoroughly worked-out, and he need say no more about it. In the case of domestic heating and cooking appliances, here, as in the case of the gas-engine, they were practically independent of the calorific value, if the relative air volumes and pressure were so arranged that the necessary flame temperature was obtained. It was possible to use any gas from 600 down to as low as 200 B.Th.U., provided the burners were suitably adjusted. The volume of air required for different mixtures of gas varied greatly. For instance, carbonic oxide and hydrogen only required 2½ c.ft. of air per c.ft. to get complete combustion; whereas methane required 10 c.ft. of air; and the very rich C_2H_4 gas required 15 c.ft. of air per c.ft. of gas.

The next use of gas to which witness referred was high-temperature furnace work—for instance, in brass foundries—and for metal-melting operations generally. This class of work depended upon the flame temperature. If the melting point of the metal was 1000° C., the flame temperature of the gas must be 500 or 600° C. higher, otherwise it was impossible to make up for the heat losses. In these cases a little richer gas was necessary to keep up the flame temperature, and a pure water gas was the best of all for the purpose. Nevertheless, even in furnaces a very material variation in the quality of the gas did not matter, so long as there was sufficient pressure.

Asked by the CHAIRMAN whether he had considered the use of governors for domestic supplies, Sir Dugald Clerk said that at one time they were largely employed. In the case of gas-engines, anti-fluctuators were fitted; but governors were not now supplied to the same extent, although they were very useful in many cases. With furnaces it was necessary to have a constant pressure.

Mr. A. BALFOUR asked if it were possible to prescribe a definite pressure for a particular calorific value of the gas.

Sir DUGALD CLERK said that between 500 and 600 B.Th.U. per c.ft. there would be no need to increase the pressure. If they got down to 150 to 250, then it would be necessary to increase the pressure materially, or the gas would not be carried through the pipes. For ordinary purposes, between 350 and 560 B.Th.U., he did not think it would be necessary to vary the pressure, provided it was two or three inches, although it would be necessary to adjust the jets.

Answering further questions as to the therm basis of charging, Sir Dugald Clerk said there was no question that by this method the public paid only for what they received; and he drew an analogy between gas being supplied on the basis of the heat in it, and the purchase of coal by large consumers on the calorific basis.

Mr. BALFOUR: Then you are satisfied that the complaint with regard to price has nothing whatever to do with the therm?

Sir DUGALD CLERK: Nothing whatever. He had always advocated the method of measuring the total heat. Of course, when gas was first used there was no question of employing it for heating, and the illuminating standard was perfectly logical; but part of the anomaly that had arisen in the course of development in the gas industry had been due to the keeping-up of worn-out shibboleths which were tying the hands of the gas industry. It was to the interest of the public that the industry should supply the cheapest possible heat and he had been pointing this out for years. When he was President of the Institution of Gas Engineers, he had suggested that the industry should aim at supplying at 5d. per therm for furnaces and gas-engines; and he noticed that gas was being supplied at 7d. per therm at Greenock for this purpose. This was coming near to his standard. As a matter of fact, in 1913 Widnes and Sheffield were supplying at the equivalent of 3d. per therm, and he would like to see the gas industry back to that. If it could be done, there would be an enormous increase in the use of gas for all industries. There was a considerable expansion going on now, but it would be five or six times as great if the gas were cheaper. At present about 20 million tons of coal were carbonized per annum for gas purposes, but this would not be far short of 100 million tons if gas were sold at the cheap prices he had mentioned. Making straight coal gas only resulted in 25 p.ct. of the heat in the coal being extracted in the form of gas, the remainder being in coke and tar. If, therefore, the industry were free to experiment to find out the cheapest way of making the heat unit, there would be an enormous development. Personally he did not care a button about the cubic foot. What he wanted was a low price per heat unit, which would redound to the benefit of the public in the long run, and result in a complete change in the atmosphere of our towns.

Mr. BALFOUR: Can you say that the introduction of the therm has already opened up a large field?

Sir DUGALD CLERK replied that that was his view, and that the development would be very much greater if the gas industry was left alone. The gentleman in the "Daily Mail" had misunderstood the whole question and knew nothing of what he had been talking about. It might just as well be said that the properties of wood changed because the method of measuring wood had been changed. [Laughter.] The real difficulty had been price; and but for this, nothing would have been heard about the therm. At the same time, Sir Dugald added, the gas industry had lost enormously during the war, and some of the reserves had been cleared away altogether. The industry had been very patriotic, and he thought it was entitled to get a higher price until it settled down again. As a matter of fact, it was now settling down and was trying to reduce the price as fast as possible. This was shown by the fact that it was 7d. per therm at Greenock.

Mr. BALFOUR: If the price is high, it is for the local authority to ask the Board of Trade to investigate?

Sir DUGALD CLERK agreed, and added that the two things, price and the therm, had become mixed in the public mind owing to a newspaper stunt. In a matter of this description, this was not the sort of thing that could be given way to, and the public must be educated.

Answering Mr. PUGH with regard to the varying efficiencies of

different gases at different calorific values, Sir Dugald referred to the work done at Leeds University under Prof. Cobb, and to the reports on this work in the Proceedings of the Institution of Gas Engineers. There might be a varying efficiency as between a 400 and a 500 B.Th.U. gas, but there was a balancing point as to the advantage in sending out a gas of a higher or a lower grade within these limits, according to the state of the market for residuals. If the price of residuals rose, then it might pay to use some of the older methods of gas manufacture. At present the question would be determined by international rather than by local conditions.

Questioned as to inerts, Sir Dugald said he was in favour of having as low a percentage of inerts as possible; but there was the Sheffield case he had mentioned in which the addition of another 4 p.ct. of inerts only reduced the flame temperature by 10° C. It had been suggested, before this experiment, that the addition of inerts produced a tremendous drop in flame temperature, but that had been proved not to be the case. In domestic supply, the question of inerts was unimportant, so long as the charge was on the heat value; if it were by the cubic foot, then the question of inerts was of vital importance. His view was that the consumer was very definitely protected against inerts by the therm system of charging.

Mr. George Helps and Costly Gas.

Mr. George Helps, of Nuneaton, was then called.

The Chairman, speaking to Mr. Helps, said that the proof of the evidence he wished to give included several points which did not strictly come within the terms of the inquiry, and he would therefore ask Mr. Helps to take only such points as were covered by it.

Mr. Helps said he had been manufacturing and using gas in this country and abroad for over thirty-five years, and had had considerable experience, both as an engineer and a contractor, with the distribution of gas through welded-steel mains at pressures up to 100 lbs. per square inch. He had also been concerned industrially for a period of over fifteen years in the manufacture of all kinds of burners and appliances. The problem presented by this controversy, he believed, would work-out its own solution. It was now obvious that gas consumers who had been accustomed to have gas measured in cubic feet were not eager to have such cubic feet translated into therms, but for therms only to be the basis of charge. There was a very good reason for the introduction of the therm, and he had been one of its strongest advocates; but he felt that it had served most of its purpose, and if the bills in future were made out both in cubic feet and therms it would only be a question of months before it would be agreed by all concerned that the charge by cubic feet alone answered the purpose so long as the bill showed the calorific value, and the price per therm, for the purpose of comparison of cost.

Answering the Chairman, Mr. Helps said he was certain the public would prefer to go back to the cubic feet charge. The only disadvantage to the public in the therm was that there was no limit to the quality on the upward grade. At the present time, with oil at 3d. a gallon, it paid gas companies to use it and get 9d., 10d., and 1s. 2d. for it. That was why some companies had increased their calorific value. He regarded high calorific value as encouraging waste, and a lower calorific value would satisfy the needs of the public better.

Mr. Helps then submitted the following points upon what he termed "Costly gas and waste of gas":

1.—Costly gas and waste of gas are more or less synonymous terms so far as the consumer's bill is concerned, and are brought about by the following causes concerned with manufacture, distribution, application, and accounts, thus:

(*a*) Costly plant and manufacturing processes at the gas-works.
(*b*) The manufacture of the concentrated essence of coal, in the form of gas, and supplying it at such inadequate pressures in the mains and services that when it reaches the consumer's appliances such pressure is insufficient for him to obtain complete combustion of it, and thus B.Th.U. in very serious quantities are wasted.
(*c*) The comparatively few average hours per day that mains and services are used at anything like their capacity. This means high cost of distribution. Cheap gas is the remedy for high distribution costs.
(*d*) Inadequate pressure at the nipples of consumer's appliances. Use of 3-lt. slot meters.
(*e*) The application of gas to obsolete burners and appliances, particularly gas-cookers, which are using on an average twice the therms they need.
(*f*) The amount of money expended on keeping lighting burners in order for small consumers, and the supply of practically free mantles in many cases and free attention. All of which is set against the cost price of gas.
(*g*) The statutory system of account, which allows all manner of charges to be set against the cost price of gas in the revenue account, and all manner of reserve funds that should not be allowed.

The chief causes are (*d*) and (*e*).

At the request of the Chairman,

Mr. Helps amplified his views on these various points. On the question of pressure, he maintained that the only position for testing was at the nipple of the burner, and 20-10ths or 30-10ths in the main was not nearly sufficient. There were thousands of meters in use all over the country which were responsible for a drop of 10-10ths or 15-10ths in pressure before the gas got to the point where it was used. It was as useless to discuss pressure anywhere else than at the nipple as it was to discuss the power of a gas-engine except at the crankshaft. In his view, the richer the gas the higher the pressure necessary.

With regard to (*c*), Mr. Helps said there were a good many distributing engineers who were satisfied that a 200 B.Th.U. gas would do the work they required; but they had got it erroneously into their minds that it would require mains of two or three times the present capacity. That this was wrong could be demonstrated in practice. Automatically, as the quality was reduced, so the pressure necessary was reduced at the nipple. With a 200 or 250 B.Th.U. gas, a pressure of 4-10ths or 5-10ths was sufficient, and therefore the capacity of the present mains was ample for the lower-grade gas.

On the question of three-light meters, mentioned in (*d*), Mr. Helps said he himself did not realize for many years that the three-light slot meter had only about half the capacity of the ordinary three-light meter, owing to the fact that when the first penny was put in, the valve in the meter opened only the thickness of a penny and the pressure was only about 5-10ths. The loss to the consumer with a gas of from 400 to 500 B.Th.U., was appalling. He had proved this at Nuneaton. When the subsequent pennies were put in, the supply was better owing to the wider opening of the valve. In his own case he had 4000 three-light slot meters, and he was doing his best to remedy the difficulty.

As to (*e*), the majority of cookers in existence were not scientifically constructed.

Dealing with (*f*), Mr. Helps suggested that the maintenance of lighting fittings and the supply of cheap mantles by the gas authority is not a good policy, on the ground that it tends to keep the price of gas up; and he added that the greatest exponents of gas management would be found using electric light. He also said that it was a waste of energy trying to do all sorts of things extravagantly for lighting. For every high-pressure lamp there was always a ladder hidden away, and a man was somewhere about, and all this added to the price.

As to (*g*), he said the point here was that many gas undertakings obtained more revenue from the sale of coke and coal than from gas. This militated against the industry generally, and prevented a fair comparison of the cost of gas manufacture in various places. At any rate, the items should be shown separately on the accounts.

Witness said there was no necessity for a burner to be constructed for use with only one kind of gas. A good burner should be equally efficient with a 600 B.Th.U. as with a 300 B.Th.U. gas. Lack of pressure and variable pressure were the disturbing factors. The reason for this facility of adjustment had not been referred to, and he gave the following table as showing that it was due to the calorific value of the self-combustible mixture being practically identical for gases having a calorific value ranging from 343 to 625 B.Th.U. He defined a self-combustible mixture as a gas and air mixture in which the air for combustion was all, or practically all, injected by the nipple, and which arrived at the burner head in a condition to produce, when lighted, a practically coneless flame. The percentage difference between 450 and 550 calorific value was 22 p.ct., and between 343 and 625 calorific value in the table below, 82 p.ct.; and yet the difference between the gas which the consumer used, or should use, in each case, was identical within 4 p.ct.

Calorific Value of Gas.	Vols. of Air *plus* 1 Vol. of Gas.	Calorific Value of Self-Combustible Mixture.	Nitrogen in Gas.
B.Th.U. per C.Ft.		B.Th.U. per C.Ft.	P.Ct.
343	4·2	81·7	30·6
475	5·5	86·3	5·5
497	6·0	83·0	17·5
506	6·0	84·3	9·8
590	7·0	84·3	0·5
625	7·4	84·5	4·3

In the burner he had shown to the Committee it was possible to get complete combustion.

Arguing that the best process of gas manufacture is that which handles and uses the least solid fuel to produce a given gaseous unit, Mr. Helps said that the best, if not the only, method of comparing gas-making processes is by a comparison of the tons of coal used to produce a given gaseous unit, a convenient unit being 300 therms, or the heat energy contained in one ton of good coal. All the main factors depended upon the quality of coal used, thus:

A. 1 ton of coal as heat energy represents 300 therms costing 30s.
B. 1½ tons of coal completely gasified will yield 300 therms costing 45s.
C. 4 to 5 tons of coal in vertical retorts with steaming will yield 300 therms costing 120s. to 150s.
D. 5 to 6 tons of coal in horizontals will yield 300 therms costing 150s. to 180s.
E. 10 tons of coal (different quality, generally cheaper than gas coal) will generate 8800 units of electricity, representing 300 therms costing, at 30s. per ton of coal, £15.

From the above figures the cost for coal per therm is—

A. Coal at 30s. per ton $\frac{360}{300}$ = 1·20 per therm.
B. " " 1·80 " "
C. " " 5·50 " "
D. " " 6·50 " "
E. " " 12·00 " " (electricity)

Looked at in this way, some very simple and useful figures are available. Although such figures are but approximate, they will be found as reliable as any produced by a more elaborate process.

Taking gas as sold at 1s. per therm, the gaseous heat energy of a ton of coal costs—

300 therms in 1 ton of coal, 30s.
300 therms in gas at 1s., £15.
300 therms in gas at 1s. 6d., £22 10s.
300 therms in electricity at 2d. per unit, £75.

The Chairman suggested that it was no use pointing out the disadvantages unless they could find a remedy.

Mr. Helps said the remedy was to gasify completely and have practically no residuals except tar and ammoniacal liquor. At the present time, the calorific value of the gas at Nuneaton was about 280.

A diagram was then handed in depicting a 400 B.Th.U. gas, a 200 B.Th.U. gas, and a 200 B.Th.U. gas with 12 p.ct. of oxygen added, which latter Mr. Helps claimed gave the same flame temperature as the 400 B.Th.U. gas, thus emphasizing what he had already said—viz., that the result depended upon what the consumer got at the burner head. Following this up, he again urged the importance of

pressure at the burner and not at the works, and handed in another diagram intended to illustrate how, with a rich gas, the gas only trickles out of the pipe in small quantities, whereas with a less rich gas it flows out at the full bore with a much less pressure, this being provided for at the burners by the nipple being comparatively large. The late Sir George Livesey many years ago stated that he had degraded the gas and yet found better results with the incandescent burner, and they should be able to get back to low pressures at the nipple if they had a low-grade gas, with higher pressures at the works. He contended that with a lower-grade gas with higher pressure at the works and lower pressure at the nipples, the consumer got a better duty out of the gas.

The CHAIRMAN suggested that a 250 B.Th.U. gas would not do for lighting.

Mr. HELPS replied that he was assuming no one used gas for [flat-flame?] lighting. If a gas suitable for lighting was sent out it would inflict hardship on those who wanted it for other purposes. The difficulty might be got over by carburetting at the burner. Continuing, he said he appeared as a practical man and was telling the Committee what he had found as the result of his own experience. He begged the Committee to see for themselves the conditions under which consumers were using gas in London to-day. They were spending two or three times as much money upon it as they need, by reason of the appliances they were using, which were supplied to them by the gas authorities. He was not speaking disrespectfully of these gas authorities, because he was doing exactly the same himself. They were all hiring cookers that ought to be on the scrap heap. They were talking of a rich gas, and were supplying that rich quality in the vilest concoctions that could be imagined.

Mr. HELPS, continuing, said that in the ordinary London gas only 20 to 25 p.ct. of the potential heat energy of the coal was taken out as gas, whereas if they completely gasified, 80 p.ct. could be obtained; and this was the ratio, more or less, in which the consumer was paying more than he need. There was not a case in the country where the consumer was not paying twice as much as he need, in all circumstances, and there were many cases where he was paying three times as much as he need. If the matter were dealt with on the lines he had suggested, the effect on unemployment would be enormous, as the cheaper gas would enable our manufacturers to get into the foreign markets. He agreed that the Press had not helped this matter very much by the outcry it had made, because they did not know what they were talking about; but the consumers had a grievance in that their charges varied because of the question of pressure, which affected the amount of gas they used.

Mr. BALFOUR questioned Mr. Helps as to his views upon incandescent gas-lighting.

Mr. HELPS replied that he did not suggest that gas ought not to be used for this purpose, because in many instances it was the best; but taking the ordinary householders, he did not think gas lighting was in the best interests of the consumers. He agreed with the therm system as long as there was a limit put upon the quality. He also agreed, after several questions had been put upon the point, that without the system he could not have carried out his own ideas at Nuneaton.

Mr. BALFOUR: Do you really want to go back to charging by the cubic foot?

Mr. HELPS: Yes. The gas industry has been accustomed to the cubic foot; and if you can get all the advantages of the 1920 Act and the therm basis, and charge by the cubic foot, I say: Why change it?

Sir JAMES MARTIN said he was surprised to hear the witness deprecate the use of gas for lighting, as there must surely be a very large proportion of the 900,000 consumers of the Gas Light and Coke Company who used gas for this purpose.

Mr. HELPS said it would be infinitely better for them if they did not, or at any rate used less for lighting and more for cooking and heating. Later he added that it would be far better to use electricity for lighting.

Sir JAMES MARTIN did not intend to become involved in an argument as to whether gas was better than any other form of lighting. A large number of people in London used gas for this purpose; and was this not due to the fact that it could be efficiently used?

In answer to further questions, Mr. Helps agreed that some of the present dissatisfaction might have been avoided if the Act of 1920 had provided for the adjustment of fittings at once, instead of after the calorific value was changed, subsequent to the original declaration.

Later, Mr. Helps said he was sorry if he had given the impression that gas was not good for lighting; it undoubtedly was.

Mr. PUGH put some questions as to the position in Nuneaton, with a 280 B.Th.U. gas; and Mr. Helps said there was complete satisfaction. Asked as to the price, Mr. Helps, after a long search among his papers, said the pre-war price was 3s. 6·15d., and to-day 3s. 8·46d. per 1000 c.ft. Converted into therm value, the figures would be 8d., and 1s. 2d. or 1s. 3d. [There were murmurs of "No," and Mr. Helps agreed that the present price was equivalent to 1s. 4d. per therm.]

The work he had been doing at Nuneaton was to demonstrate that a lower grade and cheaper gas would give the consumer all he wanted. He considered his Directors were deserving of the greatest appreciation of the gas industry, and, indeed, of the whole country, for undertaking this work. Many gas engineers had been to Nuneaton; and if only more would come, there would be fewer sending out gas of 500 B.Th.U. and above. Of 1600 gas-works in the country, probably 1400 had used no other than 500 B.Th.U. gas; and of the remaining 200, some 100 or 150 were distributing 400 to 450 B.Th.U. gas. Only four or five undertakings were sending out a gas of less than 400 B.Th.U.; and he was the only one in the country who had handled such a low-grade gas as 280 B.Th.U. Up to a point, the work had been experimental; but it had now passed this stage, and his Directors were prepared to instal a plant which would enable this low-grade gas to be manufactured and sold at a price one-third of the present cost.

With regard to appliances, he agreed that the same "miserable" apparatus was being used in Nuneaton as in London and elsewhere, and it all required to be scrapped.

Mr. W. J. U. WOOLCOCK took up the question of the work done at Nuneaton, and suggested that the net result was that gas of half the pre-war quality was being sold at 2d. per 1000 c.ft. more.

Mr. HELPS said he was glad this point had been raised. The position at Nuneaton was that they were now using what he would term a bastard plant, in that they were making rich gas in a costly manner, and diluting it with a very poor gas made in a costly way. When the new plant was installed, he had guaranteed that it would produce 170 therms per ton of coal, as against the present 70 therms, by a much cheaper process; and the gas would be better. Therefore, it would be supplied much more cheaply.

Mr. WOOLCOCK: Bournemouth are charging 10·4d. per therm, Croydon 11d., and London 10d., against your 1s. 4d. This does not disturb you?

Mr. HELPS said it did not, because it was possible to have the vilest form of gas and sell it at 2d. a unit. Moreover, it was not right to compare Nuneaton, with its 6000 consumers, with the colossal Gas Light and Coke Company's undertaking in London. What they should do was to compare the pre-war with the present price in Nuneaton, and the same with regard to London. In London it was something in the ratio of 2s. 6d. to 5s., and Nuneaton was nothing like that. Moreover, they had not yet arrived at a comparative basis as between Nuneaton and other places.

In answer to another question as to the capital cost per therm of the new plant, Mr. Helps said, in his opinion, it would not amount to ¼d.

Mr. WOOLCOCK then referred to figures of efficiency given in the proof submitted by Mr. Helps, but not actually put to him by the Chairman. These figures showed an efficiency of 54·1 p.ct. in boiling a quart of water with a 558 B.Th.U. gas, and 55·9 p.ct. with a 250 B.Th.U. gas. Witness was asked if he suggested that witnesses who had told the Committee that an efficiency of from 79 to 81 p.ct. was obtainable with the higher grade gas, were not to be credited.

Mr. HELPS said he did not know what burner they were using. With his burner he was able to get consistent conditions every time, whereas with the ordinary burners that was impossible. Again, the time factor came in. If they did not mind taking a little more time, the efficiency would be greater. The actual method of arriving at the 54·1 p.ct. efficiency in the case of the high-grade gas, he promised to send to the Committee.

There then followed an argument between Mr. Woolcock and the witness as to whether one therm is as good as another; and ultimately Mr. Helps agreed that one B.Th.U. in a poor gas was as good as one B.Th.U. in a rich gas, but he added that it was more difficult to use a richer gas.

Mr. WOOLCOCK: And the cheaper it is to make?

Mr. HELPS said he would not go so far as that—indeed, in the ordinary way a richer gas was more costly to make.

Questions were then put by Mr. Woolcock suggesting that a greater pressure must be required for the lower-grade gas.

Mr. HELPS replied that only the same pressure was required; and his experience had proved it at Nuneaton. He had forty miles of mains, and confessed that when he first took up low-grade gas he anticipated that it would cost him more to distribute, but had found that was not so. It did not matter what was the life of the gas main, it distributed the low-grade gas quite satisfactorily. There had been no stoppages and no effect upon the mains. He had taken up mains which had been down for eighteen years (part of the time distributing low-grade gas) and could detect no deleterious influence. So far as the sketch showing the gas coming out of the mains under the conditions of high-grade and low-grade gas was concerned, he confessed he was not very proud of it—it was merely a sketch.

Mr. WOOLCOCK: We will leave it at that—it is merely a sketch.

At the close of Mr. Helps's evidence,

THE NATIONAL GAS COUNCIL QUESTIONS MR. HELPS.

Mr. MILNE WATSON, speaking on behalf of the National Gas Council, pointed out to the Committee that the witness had made a large number of unsupported statements, reflecting a grave charge upon the gas industry; and he requested that a representative of the National Gas Council be allowed to ask Mr. Helps a few questions.

The CHAIRMAN agreed to this course.

Mr. FOTTRELL (Joint Manager of the National Gas Council) first asked why Mr. Helps had not applied for an Order under the Gas Regulation Act.

Mr. HELPS said he was preparing his application now. It was absurd, however, to suggest that the calorific value of the Nuneaton gas fluctuated as much as 37 p.ct. in 24 hours.

Asked as to whether he suggested his consumers were perfectly satisfied, Mr. Helps said he would not go so far as that, seeing that London consumers with 560 B.Th.U. gas were not satisfied. The complaints in Nuneaton, however, were very small, less than 100 per quarter. Some of the trouble was due to the fact that a gas of under 200 B.Th.U. was sent out during the war, and some of the consumers opened the nipples of their burners by driving nails into them; and all this had to be put right now.

Mr. FOTTRELL then made a comparison between the consumption in Nuneaton, with 55,000 population, and Hackney, which was less than one-third the size; the total consumption being the same in both cases. Did not this show there was considerable dissatisfaction at Nuneaton?

Mr. HELPS said the reason was that Nuneaton was largely a mining town, and the miners were allowed 3 cwt. of coal per week.

Mr. FOTTRELL then put it that there was no gas lighting in the streets of Nuneaton.

Mr. HELPS: Thank Heaven, no; it is electricity.

Mr. FOTTRELL: Is not it because they cannot afford to pay 16d. per therm for your gas?

Mr. HELPS said he had already pointed out how unfair it was to compare the price of gas at Nuneaton with that in very much larger towns. After mentioning, in answer to another question, that his shareholders were not satisfied, because they had not had a dividend for two years, Mr. Helps stated he had that day met a representative of the L.M. & S.R. who had expressed his satisfaction with the Nuneaton gas, but had said that the sooner it was cheaper the better. He asked Mr. Fottrell to compare the lighting of Nuneaton station with that of other stations lighted with a rich gas.

Mr. FOTTRELL then asked questions about Pleno, Ltd.

This drew a protest from Mr. HELPS, who said he had purposely refrained from mentioning any names. The burner he had shown to the Committee had no name on it, and it was not yet on the market. He told the Committee, in the form of answers to questions by Mr. Fottrell, that Pleno, Ltd., was formed to deal in his own inventions, and that they made burners and appliances under his patents.

Mr. FOTTRELL then stated that Mr. John Reid, the London Manager of Pleno, Ltd., had written letters to the Press under the title "Gas Engineer" and "Gas Consumer," suggesting that the apparatus supplied by the gas companies was wasteful, and that he had at last succeeded in obtaining a reliable burner which had the highest heating value of any burner made.

The CHAIRMAN suggested that all this was advertising Pleno, Ltd.

Mr. FOTTRELL said Mr. Helps was the principal shareholder in Pleno, Ltd., and it was considered that the writing of anonymous letters in this way by the London Manager of the Company was a very undesirable course to take.

Mr. HELPS said this line of cross-examination had put a very different aspect on the matter. He had endeavoured to obviate any personal element, but he was now being compelled to speak out upon matters he would not have done. He had 40 patents, and about 30 agreements with various undertakings. He asked the protection of the Chairman in this matter, because the innuendo was that he was putting forward something which would be of pecuniary interest to himself. Not the remotest idea of such a thing had entered his head when he came to give evidence.

Mr. FOTTRELL said there were many burners in use in the gas industry which were as efficient as, if not more efficient than, the burner that had been referred to.

The CHAIRMAN: Mr. Helps has not claimed any particular efficiency.

The CHAIRMAN endeavoured to elucidate the position, and said he did not wish to know what firm had given the guarantees, but he presumed Mr. Helps had sufficient information to know that he could obtain a plant which would give the results referred to.

Mr. HELPS said this was so. Asked as to where such a plant had been erected, he agreed that as a whole it had not been erected anywhere, but a plant was working at Oldham which incorporated his ideas.

The mention of Oldham was drawn from the witness by Mr. Fottrell, and Mr. Helps said that an action was pending as to the payment of certain sums due to him from Oldham; and he did not think these questions ought to be put. He had had letters from Oldham stating the plant was working to their full satisfaction, although it was more or less an ordinary producer plant used for diluting the rich gas.

At the close of the questions by Mr. Fottrell, the CHAIRMAN said he would call attention to the fact that, in justice to the gas companies, they were at liberty to ask any questions as to the "vile" quality of gas that was being supplied in London, which had been referred to by Mr. Helps.

Mr. MILNE WATSON, on behalf of the Gas Light and Coke Company, said he protested very strongly against that statement. To Mr. Helps: On what do you base the allegation that the London companies are supplying a vile gas?

Mr. HELPS: I do not remember saying that.

Mr. MILNE WATSON: I protested at the time.

Mr. HELPS: I said the gas was supplied to vile apparatus.

The CHAIRMAN: I beg your pardon. You certainly said gas.

Mr. HELPS: Anyway, I did not mean to say it.

Mr. MILNE WATSON: Do you mean generally that there are vile appliances in London?

Mr. HELPS replied that they were vile in so far as the consumer was paying 1s. to get a result which he would have for 6d. if the appliances were not obsolete.

Mr. MILNE WATSON stated that the London district was full of up-to-date appliances.

Mr. HELPS said he had seen appliances in London similar to those which had been in use for the past twenty or thirty years; and they were using twice the amount of gas they need. The whole industry knew it; and it was not fair that these things should not be discussed.

Mr. MILNE WATSON said that during the war it had been impossible to get anything at all in the way of appliances, but at the present moment the Gas Light and Coke Company were engaged in an enormous scheme for the scrapping of out-of-date appliances. They were putting in new appliances as fast as ever they could, and were spending an enormous sum of money in this campaign. It was obvious that this could not be done in a moment.

Mr. HELPS: Then Mr. Milne Watson and I are in perfect agreement. He agrees that these should be removed.

Mr. MILNE WATSON: I am speaking about your expression "vile appliances."

Mr. HELPS said they could call these appliances anything they liked; but he did not think too strong a word could be used in regard to appliances which consumed £2 worth of gas when they only ought to consume £1 worth. The better the apparatus, the more satisfaction would the consumer have, and this would be to the advantage of the gas companies.

The inquiry was then adjourned until Friday next.

Those Electric Lights!—A mishap to a turbine at the York electricity works on a recent Saturday night left in darkness for forty minutes everybody dependent on electricity. At the theatre the performance was continued by candle light, and at the cinemas, where pictures could not be shown, the orchestra worked overtime to the illumination by emergency gas lights. The tramway service was stopped, and the shopkeepers who use gas lighting reaped a rich harvest, while their competitors dependent on electricity were stranded in darkness, for it was the last hour before closing time on Saturday night. At Huddersfield, owing to "fatigue of material," the Corporation electric lighting broke down throughout the town on Monday night of last week. For three minutes the entire service was stopped, then a repair relighted half the load, but normal lighting was not restored until nineteen minutes had passed by.

GAS REGULATION ACT APPLICATIONS.

The following further notice has appeared in the "London Gazette" with regard to applications to the Board of Trade under the Gas Regulation Act.

SPECIAL ORDER.

Hatfield Gas Company, Ltd.

The Company are applying for a Special Order under section 10 to empower them to purchase and hold lands, to raise further capital, and to regulate the administration of the Company and the supply of gas.

GAS REGULATION ACT ORDERS.

The Director of Gas Administration has forwarded a copy of the following further Order made by the Board of Trade under section 1 of the Gas Regulation Act.

Tuxford and District Gas Light and Coke Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16·4d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five-and-one-tenth. (Jan. 4.)

POTTERIES GAS UNDERTAKING.

Marking the Completion of the Purchase.

At the North Stafford Hotel, Stoke, on Tuesday of last week, a luncheon was given by the Chairman and Directors of the British Gas Light Company, Ltd., to mark the completion of the purchase of the Company's Potteries undertaking by the Stoke-on-Trent Corporation, who will now proceed to link-up the municipal stations with Etruria, which will become the headquarters for the supply of gas throughout the Potteries. Mr. Henry Woodall (the Chairman of the Company) presided, the other representatives of the British Gas Light Company present being Mr. H. G. Palmer (a Director), Mr. A. W. Brookes (Secretary), and Mr. C. Rhodes Armitage (formerly Manager for the Company at the Etruria Gas-Works). The guests included the Mayor of Stoke-on-Trent (Mr. F. T. H. Goodwin), Mr. C. H. Bowers (Chairman of the Gas Committee), Alderman T. Mitchell (Vice-Chairman), Alderman A. Brookhouse (ex-Chairman), and Mr. A. Mackay (Gas Engineer).

The CHAIRMAN, proposing "Success to the Scheme of Unification of the Gas Undertakings of the County Borough of Stoke-on-Trent," expressed the satisfaction of himself and his colleagues at the way the transfer of the Potteries station had been effected. Rarely, he thought, had a transfer taken place in such a happy manner. The arrangement arrived at was eminently satisfactory—not to one party, but to both. The settlement was by agreement; and the very great costs which a fight would have involved were saved, to the benefit of all concerned. The Company did not want to part with their valuable undertaking—valuable because it had been managed with foresight and ability for practically 100 years. In arranging to sell they were not altogether guided by selfish motives.

The amount agreed, £385,000, was little less than the Directors first suggested as a suitable figure. Any further payment that the Corporation had been called upon to make was in repayment of expenditure incurred by the Company since the agreement was come to. He need hardly say the authorities had made for the county borough an excellent bargain. He mentioned the services rendered to the Company and to the community by Messrs. John Young, J. R. Heath, Harold Copp, and C. Rhodes Armitage, three of whom, he was glad to say, were still connected with the Company. Mr. Young was an honoured pensioner, and Messrs. Copp and Armitage were still actively engaged with the Company. Mr. Heath died in their service some seven years ago. They all sympathized with Mr. Armitage. He had just completed the practical remodelling of the works, and obtained first-class results, when it became necessary for him to decide to stick to the works or to the old Company. He decided on the latter course; and they were very glad to know that he was still with them. They hoped long to continue to benefit by his knowledge and ability. One other name he must mention, that of Mr. Brookes, their most able and courteous Secretary. They all appreciated the great service he rendered in connection with the transfer.

To him (the Chairman) it was a rather sad occasion, as it was the last time he would appear as representing gas interests in the district, with which his late father and two of his brothers were so long and honourably connected. "My uncle, Mr. William Woodall, for many years one of your Members of Parliament," said the Chairman, "first came here to manage the Longton Gas-Works nearly 70 years ago, and from that time to this the name I have the honour to bear has been connected in one way or another with this district. My brother, Mr. Corbett Woodall, and I are still Directors of the Washington Works Pottery, so I hope from time to time to visit Stoke, and may sometimes possibly be allowed to see the Etruria works, with which I am proud to have been connected. I cannot conclude without testifying to the courteous and admirable way in which the former Chairman of the Gas Committee (Alderman Brookhouse) conducted the negotiations, and to the ability and resource of your Town Clerk (Mr. Sharpley). Your Engineer (Mr. Mackay) has a great opportunity—an opportunity which he has largely made for himself by his persistent advocacy of the purchase. We all wish him every success in the important work before him. May I remind you that we have handed over to you satisfied consumers, a loyal staff, and a most excellent body of workmen, and express with confidence the hope that, under your administration, all these may be at least as satisfied as they have been in the past."

Mr. C. H. BOWERS (Chairman of the Gas Committee), in acknowledging the toast, said the words that had fallen from Mr. Woodall were deeply appreciated by every representative of the Corporation. It was apparent from the first that the British Gas Light Company's undertaking represented value for money. He believed that the way in which the Corporation had been able to negotiate the purchase was absolutely unique; and he desired to bear testimony to the public-spiritedness of the Chairman and Directors throughout the negotiations. From the very first, he thought, the Company grasped all the possibilities of development of the Potteries station. Quite recently a deputation from the Corporation had the pleasure of meeting Mr. Woodall and Mr. Brookes with regard to the interest payable upon the outstanding amount due in respect of the capital expenditure incurred by the Company on their Potteries undertaking since Dec. 30, 1920. Once again the Directors showed how anxious they were to meet the Corporation in a spirit of goodwill, and the result was a further saving to the ratepayers of £600 or £700. The Corporation felt that they had taken over from the Company a fine staff and a splendid set of workmen. As Chairman of the Gas Committee he desired to refer to the excellent work of his colleagues, and particularly to that of his predecessor as Chairman (Alderman Brookhouse), who carried through the initial negotiations with the Company. He also desired to take the opportunity of emphasizing the good work of Mr. Mackay (the Gas Engineer) preparatory to the proposal for purchase being made to the Company. With careful thought and foresight, he presented to the Gas Committee figures and reports which showed his intimate knowledge and grasp of detail of the gas undertaking. The figure which he named was within £1300 of what was eventually agreed upon as the purchase price. In the Potteries the Company left a worthy record behind; and the Corporation would have to strive hard to live-up to the Company's tradition. The Corporation were looking forward to great things in connection with the gas undertaking; and they hoped that the concentration scheme would make it possible to supply a large volume of gas at a cheap price, and stimulate the use of gas for firing in the pottery industry. He concluded by asking Mr. Woodall, as representing the Directors of the Company, to accept a handsome dinner service and coffee service from the members of the Gas Committee as a mark of their goodwill and their appreciation of the way in which the Board had met the Corporation in connection with the gas purchase scheme.

Mr. Woodall suitably acknowledged the gift.

AN UNVENTILATED GEYSER FATALITY.

The sad circumstances of the death of a Westward Ho youth were revealed at an inquest in Bristol. His name was George Tetley Jeafferson, aged 16, late undergraduate at Bristol University. He stayed at Mortimer House, Clifton, and was found dead in a bathroom. He retired in good spirits, and had used a geyser before. Just before 1 o'clock in the morning, a servant was informed that the water in the bathroom was running, and there was a smell of gas. He burst open the door, and found deceased lying senseless on the floor. There was a strong smell in the room, the window of which was closed. The pilot-light of the geyser was burning, but was not pushed full home to light the gas-ring inside the geyser. Dr. Corfield considered the cause of death was lack of ventilation of the geyser.

Mr. W. Tucker, a plumber, said the geyser was in perfect order; but there was no chimney to carry off the fumes from the top. The Jury returned a verdict that death was due to carbon monoxide poisoning, as a result of incomplete combustion in the geyser, adding that the plumber should have seen that an instruction card was nailed on the wall. Arising out of this case, Dr. Davis made strong remarks to the Health Committee, saying that, until it was made a penal offence for any tradesman to fix any such apparatus without a proper and efficient flue to take off the products of combustion, these unnecessary deaths would continue.

Gas-Poisoning Accident.—An inquest was held at Crimble, Golgar, on the body of Anthony Hoyle (78), retired woollen weaver, who was found dead in bed last Thursday week. A son said that his father went to bed in his usual spirits. Ten minutes later the gas burned low in the house, and a few minutes elapsed before further coins were placed in the slot-meter. Witness had to go on an errand, and on returning home he noticed a smell of gas. He went into all the bedrooms, and in his father's room found the gas-tap not properly turned off. The door was not quite closed. His father was sleeping, and so he did not disturb him. An hour later when he went into the room he found his father dead. Dr. Poole said he had attended the man for heart trouble, and death was probably due to heart failure caused by the amount of gas he had inhaled, which would not have resulted in death in a healthy man. A verdict of "Accidental death" was recorded.

Meter-Makers' Wages in Manchester.—A letter was read at a meeting last week of the Manchester Trades and Labour Council from Mr. F. Mason, the Secretary of the Manchester Branch of the National Union of Sheet Metal Workers and Braziers, saying that employers in the gas-meter trade had posted notices that the 7½ p.ct. paid in Manchester on meter prices would cease. The men had replied that they would revert to day work; and there was therefore every possibility of a dispute in the meter trade. "The gas-meter trade," the letter continued, "is a piece-work trade in which very little day-work is done. The reduction the employers are now after is in addition to the tremendous national reductions that have taken place in the engineering industry. This 7½ p.ct. is the remains of two 5 p.ct. awards in the Manchester engineering trade conceded in 1912 and 1913. The meter shops in Manchester, with one exception, are branch shops of London, Coventry, and Exeter firms. These firms claim that, as they do not pay the 7½ p.ct. in their main shops, they are not going to pay it in Manchester. It is for the Labour members on the City Council to do their best to stop contracts being given out to these firms." The meeting passed unanimously a resolution asking the Labour members on the City Council to act in accordance with Mr. Mason's suggestion.

GAS COMPANY'S ASSESSMENT IN EAST HAM.

The Finance Committee of the East Ham Corporation report that the assessment of the Gas Light and Coke Company's undertaking throughout the West Ham Union area has been revised, by a reduction in the various parishes of from 20 to 30 p.ct.; but subsequent to the Borough Treasurer's submission on behalf of the Overseers of East Ham to the Assessment Committee, and the representatives of Messrs. Ryde, Sons, and Browne, who appeared for the Company, that the greater portion of the undertaking in East Ham was a chemical factory, and should be assessed as such, the total assessment was only reduced by 8 6 p.ct. Had it been valued as a gas undertaking, the reduction would have been at least 20 p.ct. The financial effect of this is considerable, not only for to-day, but for the future, inasmuch as the principle has been accepted.

PROMOTING FUEL EFFICIENCY.

Coke for Steam Raising.

In an article headed "Promoting Fuel Efficiency," which has appeared in the "Manchester Guardian," Mr. E. W. L. Nicol, Fuel Expert to the London Coke Committee, says smoke means waste, but not in the way generally supposed.

It has been argued in justification of smoke emission that the carbon contained in black smoke represents only about 1 or 2 p.ct. of the total carbon in the coal; but the fact is that the unburnt hydrocarbons carry away with them not merely their own calorific capacity, but also the latent heat absorbed by them in the process of distillation. In ordinary circumstances the volatile matter in a ton of bituminous coal, in the first stage of combustion, evolves 12,000 c.ft. or more of rich combustible gas; and no doubt the escape of large volumes of this gas unburnt, or only partially burnt, together with its latent heat, accounts largely for the waste and inefficiency which appears to be unavoidable in the direct use of such coal as fuel. It may therefore be accepted that the proportion of volatile matter in coal is, in fact, a measure of the difficulty experienced in burning it efficiently. Efficient combustion, and, in turn, the efficiency of heat transmission, imply a high "temperature head" and a minimum excess of air; and it may be laid down that that fuel is the most efficient which is capable of being burnt at a high temperature with the least amount of air in excess of that theoretically necessary.

Theoretically, to burn a ton of coal the minimum volume of air required is about 320,000 c.ft. The regular use of 50 p.ct. excess, or 480,000 c.ft., is considered very good practice; but quite frequently an average of 160 p.ct. excess, or over 30 tons of air, is used to burn a ton of coal in many modern steam-boilers, giving only about 7 p.ct. CO_2 in the flue gases (which is equivalent to a heat loss of 25 p.ct.) and a corresponding low temperature-head. These facts show not only a deplorable state of inefficiency and waste on a colossal scale, but also tend to prove that the adaptation of both boiler and furnace to suit the complex composition and characteristics of our native coal fuels in their raw state is in ordinary circumstances largely impracticable. But in any case there is admission of failure generally to apply, if they do exist, the skill and apparatus necessary to maintain efficiency.

Various remedies of a more or less drastic character have been suggested with a view to obtaining better results with the skill and appliances available, and at the same time to recover some of the valuable chemical constituents of coal. These include pre-distillation at relatively low temperatures; but examination and experiment have so far failed to prove their commercial efficiency. Probably the only process designed to improve availability and efficiency in the use of coal, which has stood the test of time, and has during the past century made steady progress (restrictive legislation notwithstanding), is the high-temperature process of carbonization carried on at gas-works. These now number in this country some 1800, with an annual throughput of 18 to 20 million tons of coal; and with the freedom conferred through the Gas Regulation Act of 1920, there would appear to be no limit to the possible development of the industry, except, perhaps, an adequate outlet for the solid as well as the gaseous products of the process. For instance, of the 18 million tons of coal used annually in the Metropolis, only 4 million tons are carbonized.

The ready disposal of the coke produced is, indeed, a factor of prime importance in the economic conduct of a gas-works; and with this end in view the important London Companies in 1913 combined to promote and extend its use for steam raising. One result of their propaganda, conducted by the London Coke Committee, has been, incidentally, to improve very materially the efficiency of many boiler plants, simply by enabling them to operate consistently with the minimum practicable excess of air. No claim to superior skill in firing is made. Indeed, less than the ordinary skill is required to fire the coke efficiently, as it contains none of the smoke-producing and elusive volatiles of coal.

The extent to which the availability of coal is improved by high-temperature treatment at gas-works is probably not sufficiently understood or appreciated. Separated by this process, the solid, liquid, and gaseous combustible products are not only rendered capable of being consumed without the emission of visible smoke, but the net evaporative value of the solid and liquid fuels (coke and tar) so obtained from a ton of coal is nearly equal to that of a ton of raw coal, as ordinarily used under steam-boilers; the value of the gas, amounting to some 13,000 c.ft., and also the recoverable benzole and ammonia, being thus rendered almost a clear gain to the nation. The explanation of this improved availability or efficiency is simple. In liquid form, the tar, amounting to some 13 gallons, is readily atomized in an oil-burner by means of an air or steam jet. Burnt completely at a high temperature with the minimum excess of air, it will evaporate 14 lbs. of water per pound of tar. After allowing for the coke used in the carbonizing process, about 11 cwt. remains available. Fired in ordinary circumstances under boilers, 14 to 16 p.ct. of CO_2 is maintained in the flue gases, indi-

cating the use of only 30 to 50 p.ct. of excess air. The resulting high temperature gives a corresponding high duty, the average evaporation obtained with coke of good average quality being from 9 to 10 lbs., whereas, at 50 p.ct. efficiency, only 6 to 7 lbs. is obtained with coal.

PETROL FROM COAL.

Mr. F. D. Marshall's Calculations.

In a communication to the "Morning Post" (arising out of a reference by Sir John Cadman to Britain's stake in oil), Mr. F. D. Marshall draws attention to the enormous quantities of petrol, fuel, and lubricating oils, &c., potentially obtainable from coal. What he has to say on the subject is reproduced below.

THE WASTE OF COAL.

Coal is consumed practically under four heads: (1) Domestic, (2) industrial, (3) gas-works, and (4) coke-ovens. It is being wasted hopelessly under (1), and to a great extent used inefficiently under headings (2) and (3), owing to the neglect to recover the maximum value in bye-products.

According to the Coal Commissioners' report, our coal is consumed approximately as follows:

	Tons.
Railways	13,000,000
Coasting steamers and bunkers	2,000,000
Factories	53,000,000
Mines	18,000,000
Iron and steel industries	28,000,000
Other metals and minerals	1,000,000
Gas-works	15,000,000
Domestic	32,000,000
	167,000,000

Our total output of coal is round about 260,400,000 tons annually, of which, besides the 167,000,000 tons consumed as stated, some 93,400,000 tons are, in normal times, annually exported.

Taking the 30,000,000 tons consumed for domestic purposes as an instance, the burning of this quantity of coal represents the passing-away through the chimneys, in the form of burnt gas producing smoke and soot and other deleterious matters, of materials equivalent to—

Motor spirits (gallons)	90,000,000
Illuminating and fuel oils (gallons)	150,000,000
Heavy lubricating oils (gallons)	210,000,000
Pitch (tons)	800,000
Sulphate of ammonia (tons)	1,200,000
Gas (cubic feet)	350,000,000,000

The gross value of these dissipated products is approximately £57,000,000 annually, of which the loss of ammonia alone reaches the enormous sum of £18,000,000.

Add to these figures the losses on the industrial consumption, on the basis of an all-round consumption of 70,000,000 tons per annum, we have a loss of—

Motor spirits (gallons)	210,000,000
Illuminating and fuel oils (gallons)	350,000
Heavy lubricating oils (gallons)	490,000,000
Pitch (tons)	1,700,000
Sulphate of ammonia (tons)	2,810,000
Gas (cubic feet)	350,000,000,000

The gross value of the above would amount to £77,000,000; so that if we consider the two sources of waste together, the loss approaches the colossal sum of £133,000,000 annually.

BRITISH OIL AND PETROL.

The question will naturally arise: If the consumers of over 100,000,000 tons of coal are to be deprived of this solid fuel, what is proposed as a substitute? The reply is: For domestic and many industrial purposes, *gas;* and where the consumption of a liquid fuel is desirable, British-brewed *oil* and *petrol;* and as regards the ammonia, a cheap supply of *sulphate of ammonia* to the agriculturist, so enabling us to compete with the threatened overwhelming competition in the future of German synthetic ammonia, which industry is being developed in Germany as a very grave menace. But quite outside the bye-products enumerated, there would be as a solid bye-product from the conversion of the coal a large quantity of coke of a quality and combustible efficiency superior to that now marketed, and an enormous quantity of gas.

With the advent of new standards for the supply of gas for domestic lighting and heating purposes, based on thermal instead of the illuminating value, new problems have arisen in connection with the distillation or carbonization of coal; and the realization of such problems, quite practicable and economical, will probably revolutionize the future treatment of coal, and make a much cheaper gas obtainable. The figures given by the writer of the quantity of bye-products are not fancy or theoretical ones, but are the results of actual experimental working on some thousands of tons of coal during the past seven years. At any rate, it is certain that, with coal properly treated, there is enough petrol and oil within the confines of the British Isles to supply practically all our needs, and to make us independent of foreign supplies; and the obtaining of this oil is not detrimental to the present practices of the carbonization of coal, but is a distinct improvement and economical advantage, if the question is properly tackled.

There is no need for pessimism concerning our oil supplies.

At Bradford the Corporation Sub-Committee on Unemployment and the local Board of Guardians are in negotiation as to further schemes of utility work for the unemployed. The Sub-Committee have agreed to recommend to the Corporation several large additional relief schemes, including the laying of new gas-mains at an estimated expenditure of £14,000, subject to a Government grant being obtained up to 80 p.ct. of the amounts paid in wages.

THE NORTH-EAST COAST COAL TRADE.

From Our Own Correspondent.

It is unusually difficult this week to sum up the situation on the Newcastle Exchange, as the market cannot see, any better than the rest of the world, whither the French occupation of Germany is leading. The market has undoubtedly been stronger even than in the two preceding weeks, though perhaps less actual business has been transacted. Even if merchants and buyers have been inclined to hold-off owing to the general feeling of uncertainty, collieries are mostly in such a strong position that they have shown no inclination to cut quotations. In fact, "fancy" prices are rather the rule.

Large inquiries are reported from France, though it is difficult to obtain confirmation of this from merchants who deal chiefly with that country. There has, however, undoubtedly been a great deal of inquiry on German account, and a good deal of business has been fixed definitely for the Stinnes interests for the next six months. Though this has mostly been for steam coal (Tyne Primes and Seconds 24s. to 25s. f.o.b.), a certain amount of gas has been done; and in any case it is bound to strengthen the gas position, as most of the Durham collieries can turn their hands to bunker classes as well as gas, if that market offers better opportunity. Naturally, definite sales depend upon satisfactory guarantees for sterling payment.

Canadian business for the open season does not appear to be making the headway which collieries had hoped. It rather seems that quotations beyond about 23s. to 24s., with freights somewhat hardening, will let the U.S.A. in; and at present colliery ideas are higher than this.

It is thought that the big London gas companies are beginning to feel the market for their next contracts; and the general idea is that collieries will hold out for 23s. 6d. to 24s. for Specials, and about 23s. for ordinary best qualities. The exact terms upon which they get fixed-up finally do not, however, generally transpire in more than "rumour" form.

For prompt delivery, all qualities report themselves sold out, and very occasional sales probably depend more than anything on stemmed tonnage not turning up. Prices nominally for this and next month are 26s. for Wear Specials, 25s. 6d. for best qualities (Holmside, Boldon, and New Peltar), and 22s. 6d. to 24s. for second qualities, with practically no coal offering. The coking coal market remains equally strong, with good quality smalls done at 24s., and even 25s. asked.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From a Local Correspondent.

The gas-coal position in Yorkshire and Lancashire—as in the North of England generally—is normal, the weather contributing largely to this. With the anticipated foreign demand, it may be that during the next few weeks the position will be altered; but there is no reason to suppose there will be any great alteration in regard to either supplies or prices for English consumers. Hull coal exporters are said to be receiving numerous inquiries from Germany for the supply of Yorkshire coal. Some of the inquiries are for 20,000 to 40,000 tons—to be shipped during the latter part of the present month and February. The inquiries are chiefly for South Yorkshire best steam hards, which stiffened in price for export 6d. per ton last week and on Saturday were quoted at 26s. to 26s. 9d.; while some holders were asking 27s. per ton f.o.b. Hull. Gas coals remained firm last week; many collieries reporting that they were fully sold in this direction. The supply of slack for coke making was hardly adequate. The production of gas coke was fully taken, though export inquiry showed weakness. With regard to the coal trade generally, industries in some instances were recovering until the Ruhr trouble, and quite a good future was in prospect. In view of the state of the foreign exchanges, there is no likelihood of a boom. France and Belgium are unable to buy more than their immediate requirements, because they cannot do so profitably. Figures for general trade ruled as follows: Best South Yorkshire hards, 26s. 3d.; washed doubles, 25s. 6d.; singles, 24s. 6d.; rough slack, 14s. 3d.; dry doubles, 20s.; West Yorkshire Hartleys, 24s.; smalls, 12s. 6d.; and furnace coke 29s. per ton, all f.o.b. Hull.

COAL TRADE IN THE MIDLANDS.

From a Local Correspondent.

The market has become more animated in the Midlands. Under the impetus of the export demand, prices have hardened appreciably. Managements of some of the gas undertakings say they have been asked to pay advances on spot lots altogether in excess of any real change in the position; the uncertain outcome of the occupation of the Ruhr being responsible for the inflation. Undertakings that have not made sure of the supplies they want do not find it so easy to make up the deficiency. Most of the big buyers are holding-off, trusting to stocks and contracts to pull them through till the tension is over. They look forward rather apprehensively, however. A touch of severe weather would alter the whole aspect of the question. At present, the best grades of house coal are receiving comparatively slight attention. They are the one weak feature of the market. Stocks are low, however, and there would almost certainly be a tightening-up of prices at the first sign of the prevailing climatic conditions giving place to frost or snow. By the same token the position of some of the gas-works would become less secure. While the upward movement of prices is attributable in some measure to the fear of what may happen, it is likewise motived by the stringency which is beginning to make itself felt in many directions. The pits are making a regular output; but the expansion of demand is outrunning supply. Increasing difficulty is experienced in maintaining deliveries as they are required. This relates more particularly to nuts, beans, and rough slack, which have advanced about 1s. on the week; but it connotes increased pressure for industrial gas.

A Committee of the Clitheroe Town Council have been appointed to take into consideration the question of extending the gas-works.

TRADE NOTES.

Glover-West Vertical Retorts for Londonderry.

A contract has been placed by the Londonderry Gas Company with West's Gas Improvement Company, Ltd., for an installation of their Glover-West vertical retorts of a nominal capacity of 750,000 c.ft. of gas per 24 hours. The retorts will be of their new design. The contract includes the provision of a waste-heat boiler, coal-handling plant, foundations, and alterations to an existing retort-house building to accommodate the new plant.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 22.

Tar products generally maintain a firm tone; but there are no particular alterations in values to record, current prices being approximately as under.

Pitch, 135s. per ton, in bulk; creosote, 8¼d. per gallon net and naked; pure benzole and pure toluole, about 2s. 3d. per gallon into buyers' drums; solvent naphtha, 95/160, 2s. per gallon; 90/140 pyridine bases, about 11s. per gallon; 60's crude carbolic acid is about 2s. 4d. per gallon, at sellers' works; 39/40° ice crystal carbolic acid being from 8¾d. to 9d. per lb. in drums.

Tar Products in the Provinces.

Jan. 22.

The average values for gas-works products during last week were: Gas-works coal tar, 79s. to 84s. Pitch, East Coast, 132s. 6d. to 137s. 6d. f.o.b. West Coast—Manchester, 127s. 6d. to 132s. 6d.; Liverpool, 128s. 6d. to 133s. 6d.; Clyde, 130s. to 135s. Benzole 90 p.ct., North, 1s. 7½d. to 1s. 8d.; crude 65 p.ct. at 120° C., 1s. 0½d. to 1s. 1d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 8d. to 1s. 8½d. Toluole, naked, North, 1s. 11d. to 2s. nominal. Coal tar crude naphtha in bulk, North, 8½d. to 9d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 10d. Heavy naphtha, North, 1s. 6d. to 1s. 8d. Creosote, in bulk, North, liquid, 7½d. to 8d.; salty, 6⅝d. to 7¼d. Scotland, 6¼d to 6⅝d. Heavy oils, in bulk, North, 7d. to 7¼d. Carbolic acid, 60 p.ct., 2s. 5d. to 2s. 7d. Naphthalene, £15 to £16; salts, £6 to £8, bags included. Anthracene, "A" quality, 4d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

Strength is maintained in many directions—especially pitch, which has reached £7 per ton. South Wales briquette makers find the price now almost prohibitive, and are turning to bitumen as a substitute. Solvent naphtha has come into good demand as the result of considerable improvement taking place in the rubber manufacturing industry. Carbolic acid is firmer; crystals having reached just on 9d. per lb., and crude 60's at 2s. 3d. per gallon. Naphthalenes remain dull at £4 10s. to £5 for crude and £17 10s. for refined. There is some falling-off in the Continental demand for intermediate products; but prices are not much changed.

Sulphate of Ammonia.

This material is now moving into home consumption at the official price, which it is anticipated will be again increased for March deliveries.

Imperial Continental Gas Association's German Claims.—The Imperial Continental Gas Association have received from the Clearing Office (Enemy Debts) a sum of £188,948 18s. 1d., being a first payment (less commission) on account, in respect of the compromise award of £1,550,000 in settlement of the outstanding balance of the Association's German claims, under the Peace Treaty.

Mouse Cuts Off Electric Power.—According to the "Newcastle Daily Chronicle," a mouse was the cause of a very considerable amount of trouble at Barrow last Thursday night—all the electric power being cut off for some time by the little animal. Finding its way into the high tension box, we are informed by the newspaper, the mouse got on to a switch, thus causing a short circuit. The switch was destroyed, and the burnt body of the mouse was afterwards discovered.

A Dutch or English Holder.—Some discussion took place at a meeting of the Colwyn Bay Urban Council last week relative to the purchase of a holder. The debate followed a report of the Lighting Committee in favour of a new type of holder made by a Dutch firm, the purchase of which would save £11,678. Mr. Price Evans wished to have the matter referred back. He did not want to deal with foreigners, as he had faith in British industries. This was seconded by Mr. Bevan, who understood that the holder had not been in use outside Germany. Mr. J. D. H. Osborn said that in comparing the English with the Dutch holders, it was realized that the English were by far the more durable; but though the Dutch type was of lighter construction, there was every evidence that it would prove quite sufficient for the purpose for which it was wanted. They had carefully weighed the question of price and merit; and he felt that the members who had voted for the report were as patriotic as those who had voted against it. It being the ratepayers' money, they considered they were justified in saving £11,000 by dealing with a Dutch firm. It was to be remembered that the greater part of the money spent would be on the erection of the holder, upon which the labour would be all British. When the question was put to the vote, only three were in favour of deferring the subject; the minute therefore standing.

Sheringham Gas Capital Over-Subscribed.—The issue of £9000 of preference gas stock in the Sheringham Gas and Water Company which Messrs. A. & W. Richards recently advertised in our pages, was considerably over-subscribed: the tenders ranging from £112 per £100 down to the minimum price of par. The stock is entitled to a dividend of 7 p.ct. per annum until the end of 1927, and 6 p.ct. thereafter.

Defective Gas-Taps.—At Leeds, last week, Fred Birch (aged 74) and his wife (aged 70) were admitted to the Infirmary and detained, suffering from accidental gas poisoning, probably due to a defective gas-tap, turned a little too far in putting out the light. The old couple were out of danger after a couple of days. At Crimble, near Huddersfield, a verdict of "Accidental death" was returned in the case of Anthony Hoyle (aged 78), of Golcar, whose death was declared by the doctor to be due to heart failure (the man being subject to heart trouble) following inhalation of a quantity of gas which would not have caused the death of a healthy man. He had apparently turned too far a defective gas-tap.

Dunstable Gas Tests.—At last Friday's meeting of the Dunstable Town Council a report was read from the Gas Examiner that he made a further test on Dec. 28, and that it appeared that since his visit on Dec. 12 the Gas Company had been keeping well above the standard of 450 B.Th.U. The latest test showed 512·6 B.Th.U., with an average for the quarter of 470·6 B.Th.U. Mr. Graham thought they should inquire what the calorific power was on other dates. Mr. Jones said they should be sportsmen. The Company had often been criticized in that chamber, and perhaps had deserved it; but they had a report from an official that spoke excellently for the Company, who had kept their average well over the declared 450 B.Th.U.

Fatal Explosion at the Fleetwood Gas-Works.—There was a serious explosion at the Fleetwood Gas-Works on Tuesday of last week; one man (John Walton) sustaining fatal injuries, and another (H. Allan) being so severely hurt that he died subsequently. Workmen were engaged cleaning out the foul main which takes the gas produced in the Tully plant to mix with the coal gas. Two men were working on the top of a scrubber, making a steam pipe connection, when there was a sudden explosion inside the scrubber. The two men were thrown to the ground, both being terribly injured all over the head and body. Part of the roof of the Tully house was blown off. The inquest was opened on Thursday, and after formal evidence was adjourned.

Keighley Gas Finances.—The annual financial statement of the Keighley Corporation gas undertaking, submitted last week, for the year ended June 30 last, shows a net deficit of £896, though the gross profit amounted to £5576. From this £701 was deducted for interest on loans, and £5771 was required for sinking fund. The Gas Committee recommend the transference of £7060 from the working capital account, that £6063 be transferred to the relief of the general district rate (being the estimated cost of public lighting), and that a donation of £100 be made to the Victoria Hospital. In the previous year there was a profit of £1898; and in the last estimates it was expected there would be a profit of about £9000 this year. The price of gas was, however, reduced in July.

London County Council and Gas Supply.—Notice of motion was given by Mr. Morrison, for this week's meeting of the London County Council: "That it be referred to the Public Control and General Purposes Committees to consider and report as to (*a*) whether or not legislative or other steps should be taken to secure that gas companies should not spread illness and death by poisonous fumes, whether as a consequence of imperfect gas or faulty mains or pipes inside or outside buildings; and (*b*) whether or not recent enterprise on the part of the electricity undertakings of the Metropolitan Borough Councils of Hackney, Poplar, St. Marylebone, Stepney, and Woolwich tend to show that gas is no longer necessary to the running of a house in respect of lighting, heating, or cooking."

Gas Coal Development in South Wales.—There always has, says the "Iron and Coal Trades Review," been a scarcity of gas coal in South Wales for the steel producers, and during past years the various steel and spelter works have experienced great difficulty in obtaining coal to keep their furnaces at work. This has resulted in several of the works developing gas-coal properties. The Briton Ferry Steel Company and the Llanelly Steel Company made an arrangement with the Glenavon Colliery Company for the development of the gas-coal series in the Duffryn Valley, near Port Talbot. They have a taking of about 1500 acres, and for the past two years have been driving levels for the Rock Fawr and the Rock Fach gas-coal seams. There is therefore no sinking being done, but merely driving ahead into the mountain. So far they have driven-in to the extent of a mile, and hope shortly to be in a position to open out these seams and have a fairly big output. Other of the South Wales steel works are developing for gas coals in other directions.

The Bethnal Green Fatalities.—The Bethnal Green Borough Council, at their meeting on the 18th inst., passed a resolution of condolence with the relatives of the persons who lost their lives as a result of the escape of gas at Gales Gardens. The Works Committee stated that they were advised that the fracture of the gas-main and the consequent escape of gas were due to causes which cast no legal liability on the Council; but they were glad to learn that the Public Health Committee were considering the hygienic aspects of the occurrence. Mr. J. W. Martin (the Chairman of the Works Committee) urged that drastic action should be taken by the Borough Councils to bring about a public inquiry into the present composition of gas. Not only was it a danger to the public in general, but people were availing themselves of gas as the easiest means of committing suicide, owing to its poisonous nature. Mr. J. J. Vaughan said the Ministry of Health had a duty to the public to see that the gas was not more dangerous than it was prior to the introduction of the therm. Personally he was confident that the new system enabled gas companies to make more profits than they made before. Mr. Rawles suggested that such an inquiry should also consider the question of making it compulsory for the gas companies to test their pipes before road repair or repairing jobs were completed. Alderman Boyce stated that the Public Health Committee would probably bring up a report and recommendation on the whole matter at the next meeting of the Council.

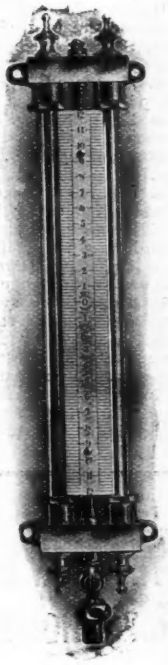
The Victory Prepayment Meter is now advertising itself, so we are bringing to your notice our

GAUGES

All Sizes

For all Purposes.

Enquiries Solicited.



SAWER & PURVES

MILES PLATTING, RADFORD ROAD,

MANCHESTER. NOTTINGHAM.

45 & 47, Westminster Bridge Road,

LONDON, S.E.

Telephone Nos. { 3289 (City) MANCHESTER. 2025 (Central) NOTTINGHAM. 2412 (Hop) LONDON.

Wires { "SAWER MANCHESTER." "SAWER NOTTINGHAM." "METRIQUE LAMB LONDON."

Lurgan Gas Undertaking.—The Lurgan Urban District Council have approved of a mortgage deed of the Northern Ireland Finance Minister (Mr. H. M. Pollock) for £13,000, for works extensions, alterations, &c.

Yeadon.—The Yeadon and Guiseley Gas Company have decided on an immediate reduction in gas charges, to the extent of 0·4d. per therm for consumption through ordinary meters, and 0·6d. per therm for slot-meter users.

Quality of Gas at Longridge.—The alleged poor quality of the gas was discussed by the Longridge District Council after the Clerk had read the Council's letter of complaint to the Board of Trade. It was unanimously decided to draw-up a petition to prove to the Board of Trade that there was just cause for an official inquiry. The Council stated that the gas was supplied by a Limited Company, and during the past year or two they had received numerous complaints—the gas being so poor that it was impossible for workpeople to see in the mills and for persons in private houses to read, in spite of the fact that incandescent mantles were used. The Board of Trade forwarded the letter to the Gas Company, whose reply was to the effect that complaints had invariably been attended to and remedied.

Conway Gas Accounts.—To a meeting of the Conway Town Council last week, Alderman Ed. Jones said that he would like to present a few figures on the gas undertaking, and to compare the present position with that shown in the abstract of accounts. Last year included the coal strike, and the position of the works was very poor. The plant was only capable of making 20 million c.ft. of gas, and their present output was between 50 and 60 millions. They had therefore to put down practically a new works. They were now giving better gas, and the savings effected for nine months amounted to £4117. They were improving their position; and though they could not reduce the price of gas while they were in debt, they were hopeful of doing so in the near future. The Mayor said that Alderman Jones's explanation of the present position was quite satisfactory.

Vertical Retorts at Leeds.—At the Meadow Lane works of the Leeds Gas Department the new vertical retorts have been put into operation. When the full new plant is at work, the Meadow Lane station will have a capacity of 8 million c.ft. per day, bringing the total output of the three Leeds works to 14 millions per day. Gas in Leeds at present is charged at 4s. 6d. per 1000 c.ft.; this being after two reductions from the war time price of 5s. 3d. But for coal and other strike episodes which have cost gas undertakings so much, there is little doubt but that the price of Leeds gas would by now have been considerably cheaper. The Leeds municipal workers' strike of 1913 cost the Gas Department a great deal. There is some ground for hope that there may be a reduction after March, in consequence of increasing output and more economical production. It is stated that if the new vertical retorts fulfil the hopes of the department, an installation of the kind is likely to be put in at the York Street works.

Gas Lecture at Leighton Buzzard.—Mr. H. G. Ruggles, the Manager of the Leighton Buzzard Gas Company, lectured the Leighton Buzzard Science Association last week on the history and manufacture of coal gas. The lecture, which was illustrated by excellent lantern slides, described with a wealth of detail how the experiment which saw its first success in the illumination of one house in Cornwall, had grown, within the space of a comparatively few years, to rank as one of the principal industries over the whole of the civilized world, and as probably the most common source of power and light. The rapidly changing methods of manufacture were also dealt with; and it was demonstrated how increased efficiency had been, and was still being, obtained from new apparatus and methods. The uses of the commodity and its bye-products also provided a wide field of survey. At the conclusion of the proceedings, a hearty vote of thanks was accorded the lecturer.

A Bradford Staff Function.—The annual staff dinner of the Bradford Corporation Gas Department took place on Jan. 11 in the magnificent banqueting chamber at the Town Hall, when there was a gathering of over a hundred persons, including the staff and wives or other lady friends. In the course of the evening, Mr. Charles Wood (Engineer and General Manager) made a presentation of an inscribed gold watch to Mr. G. H. Normington (the Chief Counter Clerk), on the completion of forty years' service in the department. Mrs. Normington was handed an umbrella. Mr. F. Senior (of the Meter Inspectors' Department) spoke in appreciative terms of Mr. Normington's labours for the undertaking and his friendship with the staff in general. The remainder of the evening was devoted to music and a toast list. "The King" was proposed by Mr. E. J. Sutcliffe (the Deputy Engineer and Manager); "The Guests," by Mr. J. Whitaker (the Chief Clerk), to which Mr. Charles Wood responded; and "The Visitors," by Mr. Sydney H. Packett (the Showrooms Manager), Councillors G. Walker and F. Wilkinson (the Chairman and Vice-Chairman of the Gas Committee) responding.

Mr. A. H. Bowers, of the Corporation Gas Department, Stafford, has been awarded one guinea by the British Commercial Gas Association, for a very neat design of seal which has become familiar through being sent out with the gas bills to consumers. Mr. Bowers has kindly given the guinea to the Guild of Social Welfare for their Boot Fund.

Through a breakdown at the generating station at Carolina Port, Dundee was recently temporarily deprived of Corporation current. The accident happened about 11 o'clock; and the first indication on the general public had of its effects was the paralysis of the tramway service. Cars on the various routes throughout the city suddenly came to a standstill; and as the minutes passed, and there was no appearance of an immediate restart being made, passengers left the cars and continued their journeys on foot. Meanwhile within the works in the city where electricity is used as a motive power the machines stopped, and the operatives had to stand by in idleness. The staff at Carolina Port Station quickly got to work; and in less than half-an-hour matters had been so far rectified that sufficient current was available to set the tramcars going once again. About twenty minutes later the city had its full supply, and industrial work was resumed.

STOCK MARKET REPORT.

The Stock Exchange has had a mixed sort of week, varying almost from day to day. The opening on Monday was very promising, alike in gilt-edged issues and some speculative lines. Home Governments, Indian, and Colonial showed the way. But Tuesday was less spirited, and a move to secure profits showed itself. Wednesday was quite a dull day, even for leading qualities; and there was not much improvement to be discerned on Thursday. On Friday, the general tone was steadier, notably in the Foreign Market. In Home Governments, the big four marked thus: Consols 56⅜, War Loan 100⅝-100⅞, Funding 88-88⅜. Victory 89⅛-90⅛. Home Rails fluctuated all the week.

Business in the Gas Market on the whole bulked a fair average, but continued unevenly distributed; few of the minor undertakings being noticed. The tone on the whole was satisfactory, though not every change was for the better. The London Companies were firm. In the Suburban and Provincial group, Newcastle and British advanced. In the Foreign, Imperial Continental attracted attention by the payment of a first instalment by Germany of the Association's Peace Treaty claims; but the price did not move, pending enlightenment as to what will be done with the money.

The following transactions in gas during the week were recorded: On Monday, Bombay 95s., Commercial 4 p.ct. 95½, 95⅝, European 8½, Gas Light ordinary 94, 94⅛, 94¼, 94½, 94⅜, ditto 3½ p.ct. maximum 64⅛, ditto 4 p.ct. preference 78, 80, ditto 3 p.ct. debenture 60⅛, 61⅛, 61½, Imperial Continental 155, 156, Liverpool 7 p.ct. preference 107, Primitiva 14s. 6d., ditto 5 p.ct. preference 51s. 3d., 52s. 3d., 53s. 9d., 54s. 4½d., South Metropolitan 95⅛, ditto 3 p.ct. debenture 60, ditto 6½ p.ct. debenture 105½, Worthing 76⅛, 77⅛. On Tuesday, Commercial 4 p.ct. 95, 95⅜, ditto 3½ p.ct. 95, ditto 3 p.ct. debenture 56, Gas Light ordinary 93⅜, 94, 94⅛, 94⅛, ditto 3½ p.ct. maximum 63⅞, 64, 64⅛, Imperial Continental 155, 157, Liverpool 7 p.ct. preference 105⅜, Primitiva 14s. 0¾d., ditto 5 p.ct. preference 53s. 6d., 54s. 6d., 55s., Tottenham "B" 101⅛. On Wednesday, Alliance and Dublin 65, Bombay 96s. 3d., British 35, 35⅛, Gas Light ordinary 93⅞, 94, 94⅛, 94⅛, ditto 3½ p.ct. maximum 63⅞, 64, 64⅛, Imperial Continental 155, 157, Liverpool 7 p.ct. preference 105⅜, Primitiva 14s. 0¾d., ditto 5 p.ct. preference 53s. 6d., 54s. 6d., 55s., Tottenham "B" 101⅛. On Wednesday, Alliance and Dublin 65, Bombay 96s. 3d., British 35, 35⅛, Gas Light ordinary 93⅞, 94, 94⅛, 94⅛, ditto 3½ p.ct. maximum 64⅜, ditto 4 p.ct. preference 80, ditto 3 p.ct debenture 60⅛, 60⅛, Imperial Continental 155⅛, 156, Primitiva 14s., 14s. 5¼d., ditto 5 p.ct. preference 54s. 9d., ditto 4 p.ct. 1911 debenture 58, 58⅛, South Metropolitan 95, ditto 3 p.ct. debenture 60⅛, 60⅜, Romford 7 p.ct. "B" 8 1/16, 8⅛, Southgate 5 p.ct. preference 90. On Thursday, Alliance and Dublin 64⅛, British 35⅛, European 8⅛, Gas Light ordinary 93⅛, 93⅜, 93⅞, 94⅛, 94⅛, 94⅛, ditto 3½ p.ct. maximum 64⅛, ditto 4 p.ct. preference 79⅛, Imperial Continental 155, 157, Primitiva 5 p.ct. preference 53s. 9d., 54s. 6d., 55s., ditto 4 p.ct. debenture 71, South Metropolitan 95, 95⅛, Swansea 7 p.ct. preference 104⅜, Tottenham "B" 100⅛, 101, South Suburban 7 p.ct. debenture 102. On Friday, Alliance and Dublin 64, Bombay 93s. 9d., 96s. 3d., 97s. 6d., Commercial 4 p.ct. 96, 96⅛, ditto 3½ p.ct 95, 96, 96⅛, European 8⅛, Gas Light ordinary 93⅛, 93⅜, 93⅞, 94, 94⅛, Imperial Continental 156, 156⅛, 157⅜, 158, Monte Video 52, 55⅛, Primitiva 13s., 13s. 6d., 13s. 9d., ditto 5 p.ct. preference 52s. 6d., 54s., 54s. 10½d., ditto 4 p.ct. debenture 70⅛, South Metropolitan 94⅛, 94⅜, 94⅜, 95, 95⅛, 95⅜, 95⅝, 96, Brentford 7½ p.ct. debenture 102, North Middlesex 5 p.ct. preference 89.

In the Money Market, the position was very remarkable throughout the week, owing to the overabundance of available supplies seeking employment which could only be found with difficulty and approached a "going begging" state before the close. Discount rates were also easy. Silver again fluctuated in response as India bought or sold, the price on Friday being ⅛d. below Monday's. The Bank of England rate was 3 p.ct., as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Transactions.
£			p.c.					
182,049	Stk.	Aug. 24	4	4%	Aldershot 4 p.c. Pref.	..	68—73	...
1,551,868	,,	Oct. 5	2½	5%	Alliance & Dublin Ord.	59—64	62—67	64—65
374,000	,,	Jan. 11	4	4%	Do. 4 p.c. Deb.	76—79	60—65*	...
280,000	5	Oct. 19	7½	4/—	Bombay, Ltd.	5⅛—6⅛	4⅛—5	93/9—97/6
100,000	5	Aug. 10	16	7½%	Bournemouth Gas and Water: 5 p.c.	..	11—12	...
383,110	10	,,	7	7%	Bournemouth Gas and Water: B 7 p.c.	15—15⅛	11—12	...
115,000	10	,,	6	6%	Bournemouth Gas and Water: Pref. 6 p.c.	13⅛—14	9—10	...
162,065	—	Dec. 29	—	4%	Bournemouth Gas and Water: 4 p.c. Deb.	..	71—76	...
992,045	Stk.	July 27	14	61/—	Brentford A Consolid.	261—266	100—103	...
734,920	,,	,,	11	61/3	Do. B New	204—209	100—103	...
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	82—87	...
221,400	,,	Dec. 14	4	4%	Do. 4 p.c. Deb.	91—93	75—80	...
214,775	,,	Aug. 24	11	11⅛%	Brighton & Hove Orig.	208—213	165—170	...
244,200	,,	,,	8	8⅛%	Do. A Ord. Stk.	154—159	120—125	...
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	..	89—91	...
530,000	20	Oct. 5	12½	22/6	British	44—45	34—35	35—35⅛
10,000	10	Dec. 29	—	7/-	Do. 7 p.c. Pref.	..	10⅛—11⅛	...
120,000	Stk.	June 29	4	4%	Do. 4 p.c. Deb. Stk.	88—90	75—80	...
245,771	,,	Dec. 29	4	4%	Buenos Aires 4 p.c. Deb.	85—87	53—58	...
100,000	10	Nov. 2	—	—	Cape Town & Dis., Ltd.	1⅛—2⅛	6⅛—7⅛	...
100,000	10	Oct. 19	—	—	Do. 4½ p.c. Pref.	4—6	6—7	...
100,000	Stk.	Dec. 29	4½	—	Do. 4½ p.c. Deb. Stk.	70—75	71—76	...
237,860	,,	,,	—	7½%	Cardiff 7½ p.c. Deb.	..	102—104	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	...
1,513,280	,,	July 27	5/9/4	56/-	Commercial 4 p.c. Stk.	106—108	93—98	95—96⅛
360,000	,,	,,	5⅛	55/-	Do. 3½ p.c. do.	103—105	93—98	95—96⅛
475,000	,,	Dec. 14	3	3%	Do. 3 p.c. Deb. Stk.	69⅛—72⅛	55—60	56
800,000	,,	Dec. 15	4	—	Continental Union, Ltd.	76—79	26—31	...
200,000	,,	Dec. 14	7	3%	Do. 7 p.c. Pref.	115—118	55—60	...
660,000		Sept. 1	—	6%	Croydon sliding scale.	..	96—101	...
284,975		,,	—	5%	Do. max. div.	..	80—85	...
492,270	Stk.	—	6	4⅛%	Derby Con. Stk.	123—125	..	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	..	...
209,000	,,	Oct. 5	—	5%	East Hull 5 p.c. max.	..	..	...
2,002,180	10	July 13	10	5/0	European, Ltd.	17⅛—18	8⅛—9⅛	8⅛
16,298,975	Stk.	July 27	4/17/4	52/-	Gas Light: 4 p.c. Ord.	98—102	93⅛—95⅛	93⅜—94⅛
2,600,000	,,	,,	3⅛	35/-	Gas Light: 3½ p.c. max.	76—79	62—65	63⅛—64⅛
4,062,235	,,	,,	4	4%	Gas Light: 4 p.c. Con. Pref.	96—99	77—80	78—80
4,674,850	,,	Dec. 14	3	3%	Gas Light: 3 p.c. Con. Deb.	72⅛—74⅛	59—62	60⅛—61⅛
130,000	,,	Dec. 11	10	10%	Coke: 10 p.c. Bonds	..	..	...
		—	—	—	Coke: 7½ p.c. Ilford Deb.	..	..	...
82,500	,,	Sept. 21	5	65/7½	Hastings & St. L. 5 p.c.	..	95—100	...
258,740	,,	,,	3⅛	50/7½	Do. 3½ p.c.	87—89	77—80	...
70,000	10	May 18	11	7½%	Hongkong & China, Ltd.	16⅛—16½	6—7	...
86,600	Stk.	Aug. 24	9	9⅛%	Hornsey 7 p.c.	..	127—132	...
1,976,000	,,	Nov. 16	9	£5	Imperial Continental	150—160	155—160	155—158
404,800	,,	Aug. 10	3⅛	3⅛%	Do. 3½ p.c. Deb. Red.	84—86	77—82	...
235,242	,,	July 27	6⅛	6⅛%	Lea Bridge Ord. 5 p.c.	119—121	95—100	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord.	..	..	...
600,000	,,	Sept. 21	—	7%	,, 7 p.c. Pref.	..	105—107	105⅜—107
265,736	,,	Aug. 10	7/5/6	87/3	Maidstone 5 p.c.	..	87—92	...
63,480	,,	Dec. 29	—	3%	Do. 3 p.c. Deb	..	53—58	...
75,000	5	June 29	6	6%	Malta & Mediterranean Met. of Melbourne: 4½ p.c. Deb.	4⅛—4⅛	3⅛—4	...
250,000	100	Oct. 2	4⅛	4⅛%	Monte Video, Ltd.	99—101	97—100	...
541,920	Stk.	Nov. 30	4	4%	Newcastle & Gatsh'dCon.	11⅛—12	52—57	52—55⅛
1,875,892	,,	July 27	4⅛	4⅛%	Do. 4 p.c. Pref. Stk.	98⅛—99⅛	83⅛—84⅛	...
98,125	,,	,,	—	4%	Do. 3½ p.c. Deb.	..	76—78	...
529,703	,,	Dec. 29	3⅛	3⅛%	North Middlesex 10 p.c.	82—83	68—69	...
15,000	10	Aug. 26	—	7/6	,, ,, 7 p.c.	..	..	...
55,940	10	Aug. 24	7/14/0	7/8⅜	Oriental, Ltd.	14—15	10⅛—11⅛	...
300,000	Stk.	Nov. 30	8	8%	Plym'th & Stonh'se 5 p.c.	117—122	95—100	...
188,120	Stk.	Dec. 29	—	72/6	Portsea Island, B	..	91—96	...
60,000	50	Aug. 24	13	65/-	Do. C	128—131	100—105	...
100,000	50	,,	12	60/-	Primitiva Ord.	118—121	85—90	...
249,980	5	—	8	—	Do. 5 p.c. Pref.	5⅛—6	8—12	13/—14/6
499,960	5	—	5	—	Do. 4 p.c. Deb.	4⅛—5	2⅛—2⅛	51/3—55/-
521,600	100	Nov. 30	4	4%	Do. ,, ,, 1911	91—93	68—73	70⅛—71
600,000	Stk.	July 27	4	4%	River Plate 4 p.c. Deb.	..	55—60	58—58⅛
346,198	,,	Dec. 29	4	4%	San Paulo: 6 p.c. Pref.	85—87	53—58	...
150,000	10	Sept. 21	6	6/-	San Paulo: 5 p.c. Deb.	10⅛—11	5⅛—6⅛	...
125,000	50	July 3	5	5%	Sheffield A	47—49	35—38	...
135,000	Stk.	Aug. 24	10	5%	Do. B	223—224	97—99	...
209,984	,,	,,	10	5%	Do. C	222—224	97—99	...
522,500	,,	,,	10	5%	Shrewsbury 5 p.c.	220—222	97—99	...
133,201	Stk.	Sept. 15	4	4%	South African	..	..	...
90,000	10	Nov. 2	9	7%	South Met. Ord.	10⅛—11⅛	7—9	...
6,609,895	Stk.	July 27	5/4/0	5%	Do. Red. Pref.	111—113	94—96	94⅛—96
250,000	,,	Jan. 11	—	5%	Do. 3 p.c. Deb.	..	94—96*	...
1,895,443	,,	,,	3	3%	Do. 6½ p.c. Deb.	72⅛—74⅛	38—61*	60—60⅛
734,000	,,	Sept. 7	—	6½%	South Shields Con. Stk.	..	105—107	105⅛
224,820	,,	Aug. 24	8⅛	8⅛%	S'th Suburb'n Ord. 5 p.c.	157—159	108—110	...
1,087,795	,,	,,	6	6%	Do. 5 p.c. Deb. Stk.	114—116	97—100	...
298,337	,,	Dec. 29	5	5%	Southampton Ord.	116—118	93—98	...
647,740	,,	Nov. 2	5	7%	Do. 4 p.c. Deb. Stk.	99—102	80—83	...
121,275	,,	Dec. 29	4	4%	Swansea 7 p.c. Pref. Stk.	..	68—73	...
250,000	,,	Aug. 24	—	21 8	Do. 6½ p.c. Deb. Stk.	..	103—105	104⅛
200,000	,,	Dec. 29	—	20 2	Tottenham: A 5 p.c.	..	101—103	...
120,000	,,	July 27	—	7⅛%	Tottenham: B 3½ p.c.	135—138	112—117	...
782,275	,,	,,	6	6%	Tottenham: 4 p.c. Deb.	115—117	100—103	100⅛—101⅛
181,255	,,	Dec. 14	4	4%	Tynemouth 5 p.c. max.	87—89	75—80	...
236,476	Stk.	Aug. 24	3	2⅛%	Wandsworth, Wimbledon, and Epsom—	108⅛—109	79—81	...
30,000	,,	July 27	8⅛	72/6	Wandsworth A 5 p.c.	151—156	111—115	...
255,636	,,	,,	6⅛	57/6	Do. B 3½ p.c.	129—134	95—100	...
108,475	,,	,,	—	50/9	Do. C	..	87—92	...
140,865	,,	,,	—	50/9	New Ordinary	..	87—92	...
352,000	,,	,,	6⅛	53/9	Wimbledon 5 p.c.	117—122	95—100	...
98,000	,,	,,	6⅛	58/9	Epsom 5 p.c.	121—126	95—100	...
88,416	,,	Dec. 29	3	3%	3 p.c Deb. Stk.	66—69	36—39	...

* Int Div.

Demy 4to. Limp Cloth. Price 10s. 6d.

THE FLOW OF GASES and PROPORTIONING GAS MAINS.

By

F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E.

WALTER KING, LTD., "GAS JOURNAL" OFFICES, No. 11, Bolt Court, FLEET STREET, E.C.4.

GASHOLDER AND TANK CONSTRUCTION AT THE SUTTON GAS-WORKS.

1,000,000 cubic feet capacity.

By F. SOUTHWELL CRIPPS.

Price 10/6 net.

WALTER KING, LTD., "GAS JOURNAL" OFFICES, No. 11, Bolt Court, FLEET STREET, E.C. 4.